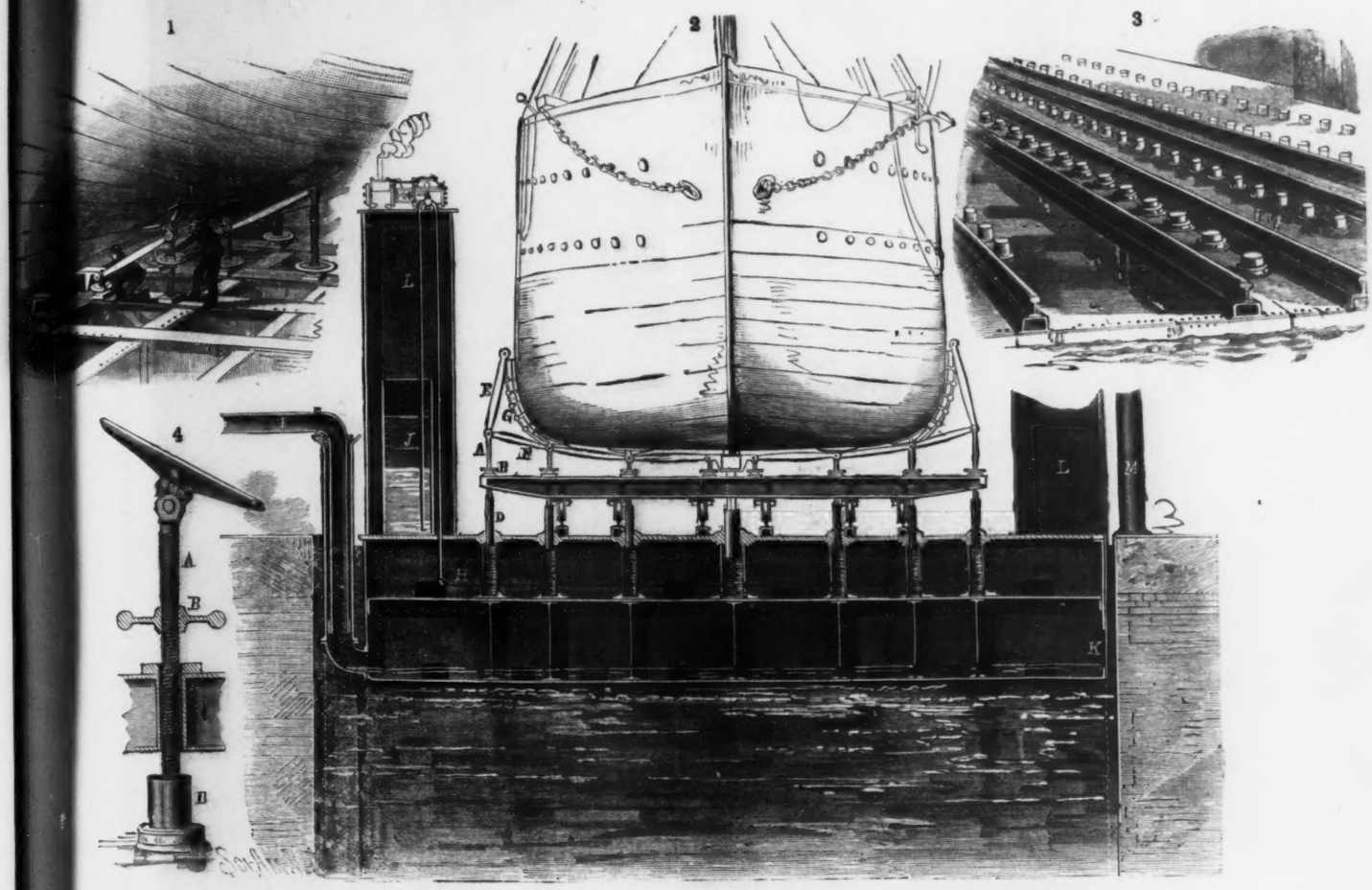
THE INTEROCEANIC SHIP RAILWAY.—Sectional Elevation of Pontoon and Railway Cradle.

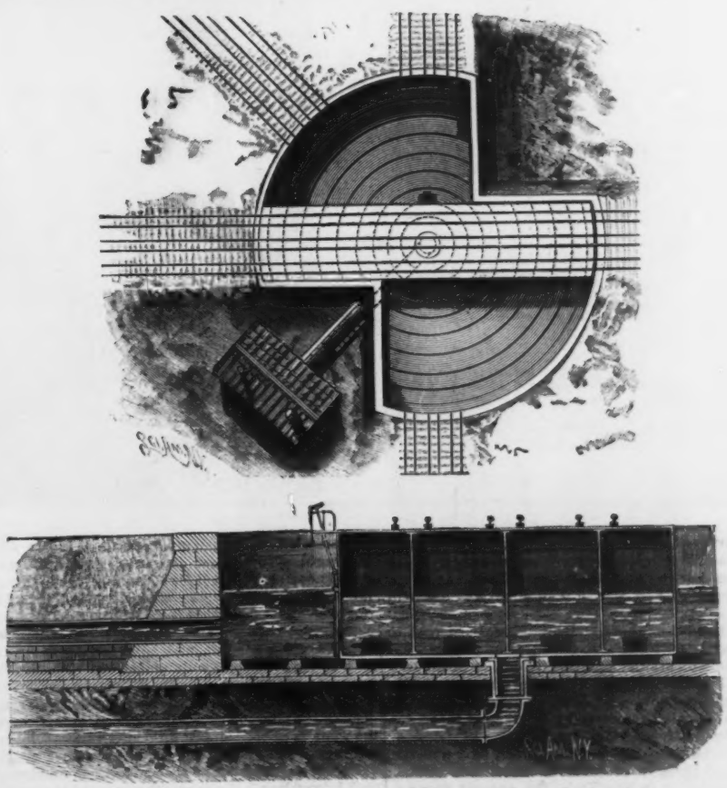


The Tehuantepec Ship Railway.

For the illustrations accompanying the following sketch of this proposed ship railway from the Atlantic to the Pacific we are indebted to the officers of the company; they were engraved by, and first issued in, the *Scientific American* of Dec. 27. The description is condensed from data supplied by the company, and from London *Engineering*.

The Isthmus of Tehuantepec lies immediately north of the promotory of Yucatan, and is the narrowest part of the Isthmus of Mexico. A line drawn between the two termini of the proposed railway is almost due north and south. The ground has often been surveyed with the idea of cutting a canal, and notably in 1774 by Don Augustin Cramer, in 1824 by Don Tadeo Ortiz and Don Juan de Orbegoso, in 1842-43 by Senor Moro, and in 1852 by Mr. J. J. Williams on the part of the Tehauntepec Railway of New Orleans. This last engineer is associated with the present project, and several of his colleagues have been engaged in previous undertakings in the same neighborhood. The concession granted to Mr. Eads gives a right of way across the country about one quarter of a mile in width, upon which he may construct a ship railway and a line of telegraph. He also enjoys a free right of way on public lands; exemption from all duties on ships, passengers, and merchandise in transit; free importation of all materials required for the railway; exemption from all taxes and contributions on capital stock and property; a grant of 1,000,000 acres of public lands; and a guarantee of protection by the military and naval forces of the country without expense. The terminus of the railway on the north is on the banks of the Coatzacoalcos River at the town of Miniatitlan, about 25 miles from the mouth of the river. This is a broad deep stream, and requires improvement by artificial means only at one point. At the mouth of the river is a bar formed by deposit, and this it is designed to deepen by jetties similar to those at the mouth of the Mississippi. There is now about 15 feet of water over the bar. The line ascends by easy gradients of 42 feet to the mile over the Atlantic plains for about 35 miles. It then enters a gently undulating table-land, from which it passes by a series of broad valleys to the summit level, the Tarifa plains, 725 feet above the sea. The descent from this point to the Pacific plains has a uniform grade of 1 in 100, and requires three deflecting turntables, since curves of less than 20 miles radius are inadmissable from the form of the carriage, as will be seen later on. From the base of the mountains to the Pacific terminus the line extends over a nearly level country, the station being either at Salina Cruz or on one of the lagoons, as may be found convenient. The climate of the country is quite salubrious, and the surveying parties have been at work there for seventeen months, part of them in the rainy season, without any sickness.

The entire line has been carefully and conscie



FIGS. 5 & 6.—ILLUSTRATIONS OF THE TURNTABLE.

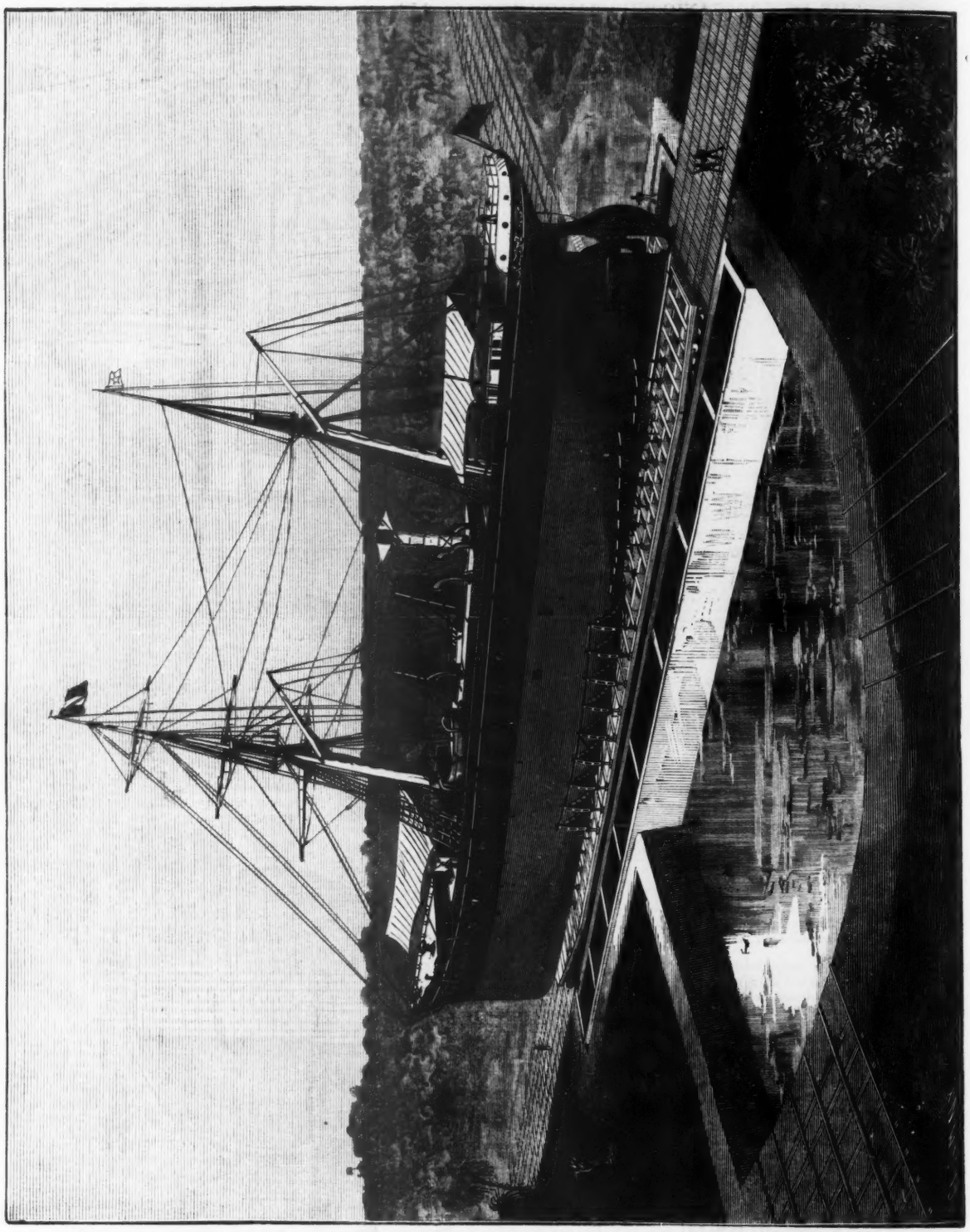


FIG. 7.—THE INTEROCEANIC SHIP RAILWAY.—THE FLOATING TURNTABLE.

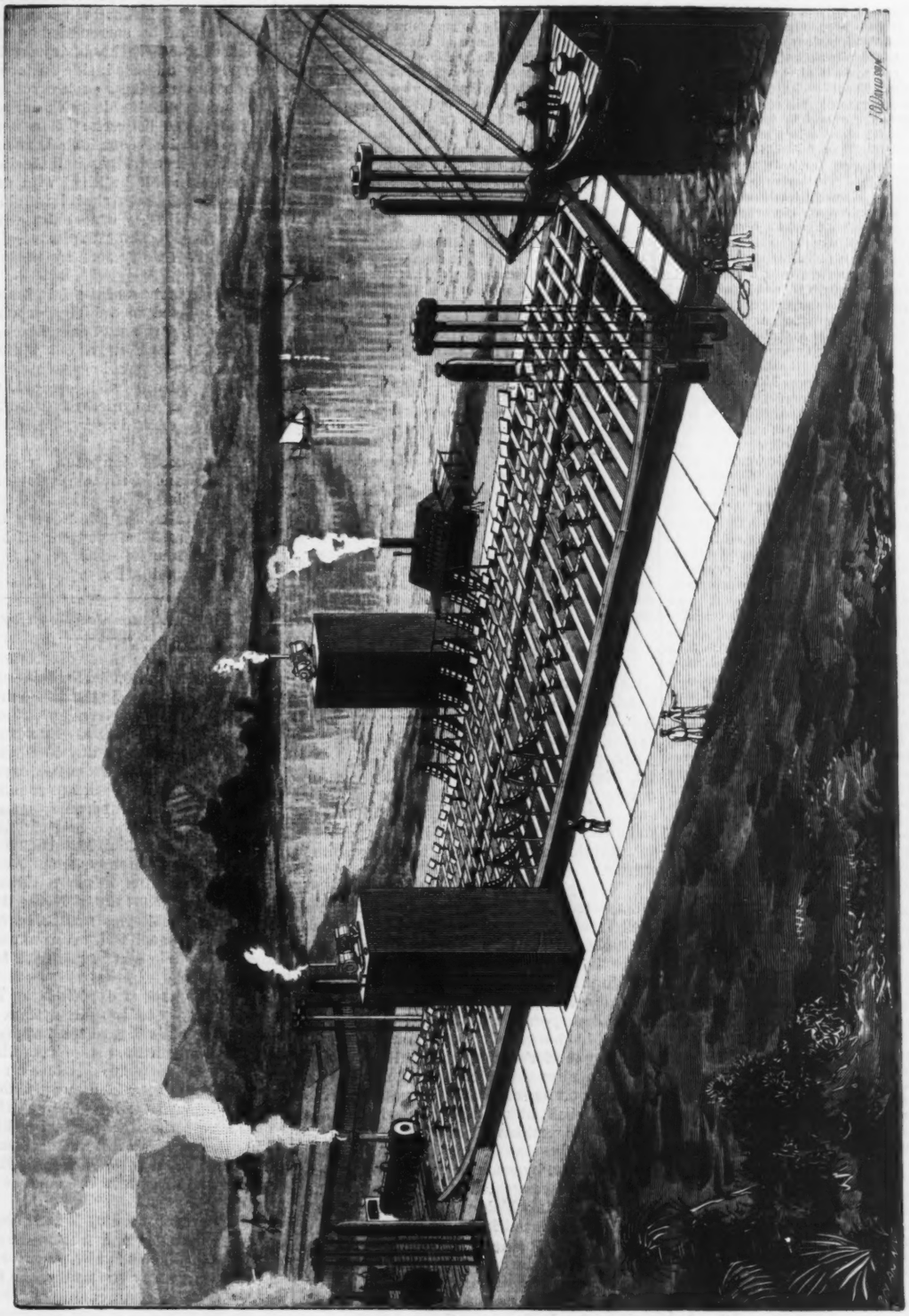
tiously surveyed, under the direction of E. L. Corthell, C. E., formerly in charge of the construction of the South Pass jetties, and later, Chief Engineer of the West Shore R. R., and Martin Van Brocklin, Resident Engineer on the Isthmus. As a consequence, sufficient data is at hand to enable a reliable estimate of cost to be made, and the means of overcoming possible obstacles to be well studied, and the difficulties of the way provided for. To further illustrate and practically demonstrate the novel problem, an elegant working model, too large to be regarded as a toy, was made for Mr. Eads by the Messrs. Holtzapffel & Co., of London. In this model the steamer itself is 7½ feet long and the car, dock and basin in proportion. From this model, while on exhibition in New York, the present engravings were made.

We have already described the details of the working of this ship railway, but we reproduce this description from the text accompanying the original engraving.

The pontoon, or floating dock (see Figs. 1 to 4,) is of the same general construction as those in use all over the world, save in some important modifications rendered necessary to fit it for its special work. For it is not enough that the vessel should be docked and lifted out of the water, but that it shall be caused to rest upon a cradle in such a manner that its weight shall be equalized fore and aft, and thus enable the carriage with its load to move easily and safely. This is effected by means of a system of hydraulic rams arranged along an intermediate deck about six feet below the upper deck of the pontoon (see Fig. 2.) The arrangement of the rams is in both lateral and longitudinal lines, the former standing a little less than seven feet apart, the one from the other. The area of the combined rams in each lateral line is the same: the area of the one ram under the keel forward or aft is equal to the area of the five or seven rams amidships. They may be connected and made to work in unison, so that the same pressure per square inch of surface of the rams will exist throughout the whole system, or they may be disconnected by valves, so that a greater pressure may be brought upon the rams in a certain section or on a certain line.

It is no part of the duty of these rams to lift the vessel. They are designed only to resist its weight as it gradually emerges from the basin. They get their power from a powerful hydraulic pump placed on a tower affixed to the side of the pontoon, and rising and sinking with it, but of such a height that, even when the pontoon rests upon the bottom of the dock, it is not entirely submerged. The pontoon itself is directed by powerful guides, which cause it to descend and emerge from the water always in the same position.

A ship having entered the mouth of the Coatzacoalcos River, on the Atlantic side, and come up to the basin, the carriage with its cradle is run on to the floating dock, when water is let into the compartments of the pontoon, and dock and cradle gradually sink to the bottom. Then the ship is brought in from the exterior basin, and so adjusted as to position that her keel wil



THE INTEROCEANIC SHIP RAILWAY.—THE LIFTING PONTOON AND RAILWAY CRADLE.

be immediately over the continuous keel block of the cradle, and her center of gravity over the center of the carriage. The water is then pumped out of the submerged pontoon in the manner employed in floating dock systems, and it rises gradually, bringing the cradle up under the ship's hull (see Fig. 2). As soon as the keel block of the cradle is close to the ship's keel, the hydraulic pump is called into action, and pushes up the pendent rods and posts of the supports gently against the vessel, closely following the lines of her hull and the run of the bilge. The pressure upon the rams increases as the vessel emerges from the water, but the water pressure under them being prevented from escaping by the closing of the valves, the ship's weight, when she stands clear of the water, is borne by the rams by means of the supports.

In the case of a ship weighing five thousand tons, each of the fifty lines of rams would, of course, be called to sustain a burden of exactly one hundred tons; and these lines being placed at equal distances the one from the other, it will readily be seen that each unit of the ship's weight is equally distributed. The weight and displacement of the vessel is learned from the pressure gauge on the hydraulic pump.

The vessel being clear of the water, hand wheels or adjusting nuts that move in threads cut in the columns of the supports, are run down to the bearings in the girder plates, whereupon the valve is opened and the rams withdrawn, leaving the girders to support the weight of the ship. Now each girder has the same number of wheels, and, as described above, bears its just proportion of weight and no more; hence each of the multitude of wheels under the carriage is called upon to bear the same weight. This weight has been calculated to be only from eight to nine tons, though tested to twenty.

One of the many ingenious contrivances in the scheme is the "hydraulic governor," so called, and by which the unevenness of the plane of the pontoon, when it comes to the surface with its load, can be readily corrected. This apparatus is thus described:

"Two cylinders are attached to each corner of the dock, one being upright and the other inverted. Plungers attached to the pontoons move in them. These two cylinders are connected by pipes, and all spaces in the cylinders and pipes are filled solid with water. As the pontoon rises, the water, forced out of one cylinder by the ascending plunger, is forced into the inverted cylinder on the diagonal corner where the plunger is being withdrawn. Now if there is, say, one hundred tons preponderance on one end of the pontoon, one-half this weight, or fifty tons pressure, will be exerted by each plunger on that end upon the water in its cylinder. This pressure is instantaneously transmitted through the pipes to the water in the top of the upright cylinder in the opposite diagonal corner, which acts with the same amount of pressure as a water plunger upon the metal plunger to hold it down; thus an equilibrium is maintained, and the pontoon compelled to rise and fall perfectly level. It is possible by aid of a pres-

sure gauge attached to the pipes to ascertain the exact amount of the excess of weight, so that, should this gauge show too great a preponderance, the pontoon must be lowered and the ship placed in a new position."

The pontoon cannot elevate the rails on its deck above what would be a prolongation of the rails ashore, because of the heads of the anchor bolts or guiding rods, and these will also prevent any tipping of the pontoons when the ship-burdened cradle is moving off. The carriage, with its cradle which comes up upon the submerged dock, is calculated to hold a ship even more firmly than the launching cradle used at the ship yards, with its shores and stays. This carriage moves upon six rails, three standard gauge tracks each of 4 feet 8½ inches. Ships themselves are girders, and must of a necessity be so, from stem to stern, because in the tempestuous seas in which they are designed to roam, the one part is constantly being called upon to support the other; now her bow projects over a great billow with nothing under to support it, and again she is poised upon a huge wave, leaving the midship section to support in great measure both the bow and the stern, and were she not constructed as a girder fore and aft, her back would be broken in the first big sea she encountered. Comprehending this, the designers of the ship carriage make its strength reach its maximum in the cross girders, which are spaced like the lateral lines of the rams already described; that is to say, 7 feet apart, and having sufficient depth and material in their plates to insure an equal deposit of weight upon all the wheels. These latter are double flanged and are placed close together, each being hung independently on its own journals, and having its own axle. Under an ordinary railway car the four or six wheel trucks move together about a central pin. But in the ship carriage, which is not designed to move off from an almost straight line, this is not required, and greater strength is obtained by adhering to the rigid principle; elasticity being had by placing a powerful spring over each wheel. These springs will, as said before, bear a weight of twenty tons and have a vertical movement of about 6 inches, while the maximum weight they will be called upon to bear will not depress them more than three inches, and allow for crossing irregularities without bringing an undue weight upon the wheels.

There is also a system of supports for the vessel, each having adjustable surfaces hinged to the top of the supports by a toggle joint in such a way that they may be made to closely follow every depression and yield easily to every protuberance or bulging. They pierce the girders of the carriage, and are exactly pendent over the hydraulic rams when the carriage is on the pontoon and rests in its proper position. Thus, as will be seen, the ship when crossing the Isthmus rests upon what might be called a cushion, and indeed she will have experienced far rougher treatment, both in the Atlantic and Pacific under only ordinary conditions of weather than that had while *in transitu* by rail across the Isthmus.

As said before, the road is designed to be almost exactly straight, since there will be no curves having a radius of less than twenty miles, for the carriage is four hundred feet long, and rests upon wheels which, as already explained, are not set on trucks swinging to a common center. There are only five places in the whole line where it is necessary to deviate from a straight line, and at each of these places a floating turntable (see Fig. 5 to 7) will be built. These turntables in design resemble pontoons, for they rest upon water, and will be strong enough to receive the carriage and its burden. The turntable pontoon will be firmly grounded, when the carriage is run upon it, by the weight of water upon the circular bearers of the basin.

The water is pumped out by a powerful centrifugal pump, the water being emitted through an opening in the cylindrical pivot of the pontoon and discharged into the basin. Now, the pontoon has been made sufficiently buoyant to be turned easily upon its pivot by steam power, and the ship carriage is quickly pointed in its new direction. The valves then permit the water to enter once more, and the pontoon turntable again rests on its bearings. These turntables may be made to serve another purpose. By their means a ship can be run off on a siding, so to speak, where she can be scraped, painted, coppered, calked, or otherwise repaired without removal from her cradle, and thus be saved the heavy expense of going on a dry dock.

The locomotives for hauling the ship carriage over the Isthmian Railway will not differ from those in ordinary use. The big freight engines of the day have no difficulty, as we know, in drawing freight trains of a total of two thousand tons; and as the ship carriage moves along three tracks it would be easy, if such a course were necessary, to place three locomotives in front of it and three behind. The time estimated for crossing from ocean to ocean is only sixteen hours.

Accepting the engineering features of the scheme as feasible, and they have been approved by some of the best engineering and naval experts of England and America, the next point to be considered is the cost of construction and the future success of the project from a commercial or dividend-paying stand point.

As we have said before, there is reliable data upon which to figure the cost of the Eads' railway and experts estimate the expenditure required at $60,000,000, or at $75,000,000 at the utmost. In this point of ultimate cost the plan of Mr. Eads differs widely from the schemes of some of his competitors, notably the Nicaragua Canal project, where the estimates range from $40,000,000 to $140,000,000, and none of these are based upon reliable engineering information.

In comparing the ship railway with a canal with locks or even at sea level, the advantage lies with the former. Speed in transit is the measure of the commercial success of any scheme for passing from one ocean to the other. The plan by which the greatest number of vessels can be safely transported in a given time and with the least tonnage tax, due cost of construction, will be the one selected by the owners of vessels. The speed of ships through the Panama Canal is put down at 2½ miles per hour, but the railway can carry them over 10 miles in the same time, once the vessel is on its cradle. The roadway necessarily well built in the beginning, will require less expenditure comparatively than any canal, with the liability to the latter of damage by flood or the filling of the channel from the side-washing in the rainy season. As the ratio of paying cargo to dead load would be so much in excess of that on an ordinary railroad, the operating expenses should be correspondingly decreased; and conservative estimates put the current estimates and cost of maintenance at 50 per cent. of the gross receipts, while others figure it as low as 40 per cent.

As to probable business across the Isthmus, the Paris Inter-oceanic Canal Congress of 1879, estimated the gross tonnage at 7,250,000 tons in 1889. Assuming 6,000,000 tons as a safe basis of estimate, and a tonnage tax of only $2.00, and deducting 50 per cent. for operating expenses there remains a net profit of $6,000,000 or 8 per cent. on $75,000,000; at $3 per ton, the net profit as above would be 12 per cent. While all estimates on the financial future of any project involving so large an outlay must be more or less unreliable, there certainly seems a sound basis for this one when we consider the great success achieved at Suez, where the dividend in 1882 was 17 per cent. and the owners look with confidence for 30 per cent. in 1890.

Transporting Explosives.

So many inquiries have reached the Railroad Commissioners of Indiana, regarding the new regulations concerning the transportation of explosives that the following rules have been prepared by them:

1. Liquid nitro-glycerine, or leaky dynamite powders, or gun-cotton other than pulverized and compressed gun-cotton, shall in no form and under no circumstances be transported in any public conveyance, or by any common carrier.

2. Nitro-glycerine in any of its forms may be transported by railroad companies in a congealed state, and in cars specially provided for the exclusive carriage thereof; provided, that the packages in which such nitro-glycerine is contained are during transportation kept constantly packed in ice under the direction of the railroad corporation transporting the same, and are in charge of a competent agent, furnished by the forwarder, who shall, during the time such nitro-glycerine is in the custody of the transporting company, be under its control, and shall, at all times, travel in the car in which the explosive is carried.

3. Nitro-glycerine in any of its forms may be transported by common carriers other than railroads in a congealed state; provided, that the packages in which said nitro-glycerine is contained or placed in boxes or refrigerators, which shall be constantly packed with ice under the direction of the common carrier undertaking to transport the same, and shall be in charge of a competent person furnished by the forwarder, who shall, during the time such nitro-glycerine is in the custody of the common carrier, be under its control.

4. Nitro-glycerine shall not in any form, or under any circumstances, be transported by any common carrier in any public conveyance or train used in whole or in part for the carriage of passengers.

5. Pulverized gun-cotton in a compressed form and in a moist state, and all dry explosive powders commonly known as high explosives, as dualin, giant-powder, rend-rock, dynamite, etc., made in part of nitro-glycerine, may be transported by railroad companies upon freight trains, and by all other common carriers in public conveyances, in wooden cases holding not exceeding one hundred (100) pounds, not less than five (5) pounds of explosives; provided, that such explosives are packed in dry sawdust, as follows: When in bulk such explosives shall be surrounded on all sides with at least three (3) inches of dry sawdust between the powder and the inside surface of the case. When in cartridges, each cartridge shall be surrounded on all sides with dry sawdust, and all interstices between such cartridges and a space of at least one inch between the outer side of such cartridges and the inside surface of the case shall be filled with dry sawdust. Each of such cases shall be plainly marked, on at least three (3) of its sides, with the name of its contents, and "Explosive—Dangerous," so as to be readily seen by those who are to handle it.

6. All explosives of the fulminate class may be transported in vehicles, or on trains not used for the carriage of passengers, in wooden, water-tight kegs, in a wet state; provided, that such water-tight kegs are placed in wooden packages filled in with sawdust, which shall be marked in the method prescribed in the case of dry explosives in the foregoing rule, number 5.

7. Large percussion caps or exploders, or other substances, the explosion of which by fire will explode the powders referred to in the foregoing rules, shall in no case be transported in the same railroad car with such powders, or within the distance of 50 feet of the same in any public conveyance.

The Purification of Water by Iron.

According to *Le Genie Civil*, the process of purifying water intended for domestic purposes at Antwerp, by passing it through a mixture of sand and spongy iron (described in ENGINEERING NEWS, Dec. 6, 1884) did not give perfect satisfaction; not from any lack of success in the purification, but from the expense of the process and the large surface required.

When, therefore, it becomes necessary to increase the distribution, and the filtering apparatus in proportion, Mr. Anderson, the engineer of the Company, sought out another method. The problem was a difficult one, for the water of the River Nethe is strongly charged with coloring matter, both from the peaty nature of the soil traversed and from the exceedingly fine earthy particles held in suspension.

After a number of experiments, Mr. Anderson determined to adopt a system which included the agitation of the impure water by iron in a finely divided state. As with the iron sponge, he expected to produce an oxydizing chemical action, which would destroy the organic impurities, and also a filter which would arrest the other objectionable matter. As in other processes, it was necessary to pass the treated water through a sand filter to supply the aeration lost by contact with the metal.

The apparatus used by Mr. Anderson was a revolving cylinder $4\frac{13}{100}$ feet in diameter and $5\frac{41}{100}$ feet high furnished with pipes for leading in and carrying away the water. In the inside works a small noria or chain of buckets, which lifts up the particles of iron and empties them at the top of the cylinder so that they descend through the liquid. An arrangement, not described in detail by the inventor, insures the equal distribution of the iron particles and prevents them from passing out with the escaping water.

Contrary to the opinion of Mr. Bischop, who regarded a contract of 45 minutes as necessary between the liquid and the reagent, Mr. Anderson has established by direct experiment the fact that a contact of 3½ minutes was sufficient to purify the water of the Nethe. The head under which each cylinder works is about 5 feet, and the delivery, corresponding to the above given time of contact, is 165 gallons per minute. The water leaves the cylinder little different in color from distilled water,

and the proportion of free ammonia is from 0.000456 to 0.000043 *grammes per litre*; for the albuminoid ammonia, the rate is 0.000174 to 0.0000581 *grammes* per *litre*.

Each cylinder makes one-third of a turn per minute, and consequently requires little power. The entire plant necessary to treat 2,383,000 gallons (9,000 mc) in 24 hours only occupies a space about 23 by 30 feet. The charge of iron is 495 lbs. (225 kilos.), and the quantity combining with the water does not exceed "2 grammes per cubic metre." It should be remarked that in the upper part of the cylinder a gas is formed, in considerable quantity, which contains only 8 per cent. of oxygen; the rest is azote, and the disengagement of this latter gas shows the necessity of passing the treated water over sand filters to aerate it.

Rock-drills Run by Electricity.

Les Annales des Travaux Publics, for January, says that M. Taverdon has successfully applied electricity, as a motive power, to rock-drills.

The system adopted consists in the use of drills armed with black diamonds at their extremity, capable of cutting away the hardest rock. In attaching these diamonds, they are first electroplated with copper and then fixed by a very hard solder into the holes prepared for them in the drill.

The electric motor is carried upon a special carriage, with a driving pulley and belt for the transmission of power. The drill is fixed upon the usual drill column, and, instead of being fitted to run by steam or compressed air, is provided with a belt-pulley and the proper mechanism to run the drill.

The motor is a Gramme machine, of the type used for a number of years past at Sermaise. On the same carriage with the motor is a reservoir of water, with an air space in the upper part of the vessel, the water being supplied under any desireable head. This water is forced by the pressure-head into the drill and down into the drill-hole from which it washes out the debris produced by the drilling.

The advantage claimed for this motor is that by using it at the heading, the long lines of steam or compressed air pipes, usually employed, are entirely avoided, and that the stoppages in the work are less frequent. No record is given of the rate of drilling or, in fact, any data concerning the actual use of this electric drill.

Motive Power from Hydrant Pressure.

Within the last few months, Montpelier, Vt., has finished a system of water-works, costing $60,000, which involves some features adaptable with profit to other localities.

They may be described as follows: The supply is obtained from Berlin Pond, 3 or 4 miles distant from the center of the town and covering about 600 acres, and is supplemented by a 6,000,000 gallon storage reservoir. The water is from springs, and is of the purest quality. This source of supply is 360 feet above the level of the town, and thus offers a dynamic value of one actual horse-power for each 12 gallons of flow per minute, which some of the citizens have already utilized.

With water under pressure and flowing in mains of ample capacity, a number of manufacturers, after examining numerous water motors adopted to the economic development of power from hydrant pressure, have selected the Tuerk Motor as best suited to their purpose. This is an undershot percussion wheel, with automatic governor, and at this date there are twelve of them in actual operation in the town. The users report as follows on the duty of these motors: two of them have replaced respectively a 10 and 12 H. P. Steam Engine, in the newspaper offices, and others are used in printing offices, in sawing marble, and in various other industries. These motors aggregate about 60 nominal horse power.

The utilization of this hydraulic power was taken into consideration by the original builders of the works, and consequently the supply mains are ample in capacity. The users of the motors are loud in their praise of the power thus brought to their doors, and especially thankful for the freedom from the annoyance, danger and consumption of time involved in the use of the, to them, old-time steam engine, with its boiler, coal supply, smoke and dirt.

With Ropes for Heavy Cranes.

An overhead travelling crane at the works of Messrs. Haniel and Lueg, of Grafenberg, near Düsseldorf, capable of lifting with double gearing up to 15 tons, gave considerable trouble from frequent breakage of the lifting chain, which was mainly due to its being wound double upon the drum, which had been chosen of too small a diameter. The danger and expense arising from these breakages necessitates an alteration; and after lengthy consideration it was decided to try wire rope, although no precedent for its application to anything like such heavy loads could be found. The rope chosen to replace the 1¼ in. chain was made of 373 steel wires of 1 millimeter diameter, and has a tensile strength of 76 tons per square inch. The rope has an outside diameter of 1¾ in., and a total breaking strain of 146 tons, or nearly ten times its working strain. While previously, with the chain, the load was carried on a single pulley by a double chain, with the rope an additional pulley has been added, suspending the weight on four ropes; and to partly compensate for the reduced speed of lifting, the diameter of the rope drum has been increased from 17¾ in. to 22⅝ in. The rope now finds ample room on the drum, and has, during more than nine months, with an average working time of 16 hours per day, given every satisfaction. The two pulleys over which it works are 17¾ in. in diameter. The rope was made by Messrs. Felton and Guilleaume, of Mulheim, and was galvanized to protect it against the weather. Its cost was 14*l*. 10s., as against 28*l*. for the chain previously used, or 75*l*. for a Gall link chain, which among others was taken into consideration.

Streets and Roads.

DECISION BY THE STATE SUPREME COURT SUSTAINING SPECIAL ASSESSMENTS.

SPRINGFIELD, Ill., Feb. 2.—A decision has been rendered by the Supreme Court in the case of Ellen Murphy et al. vs. The City of Springfield. It involves the validity of the street-paving ordinance, and assures the authorities that they may safely proceed in the future according to the method heretofore adopted in making assessments. The opinion is by Justice Craig. It sustains the decision of Judge Matheny. The pith of the decision is that it is legal, under the General Incorporation act of this State, for municipalities to assess a special tax for street-paving, equal in amount to the cost of the improvement, upon the lots and land abutting on either side of the street or alley in proportion to the frontage of said lots and lands upon said street or alley. There are two modes provided by State law for such improvement—by special assessment and by special taxation of contiguous property, and the corporate authorities of the city must determine which mode shall be adopted, and their determination is final. The imposition of the tax by the city authorities is of itself a determination that the benefit will be as great as the burden imposed. The City of Springfield complied with all the requirements of law in levying the special tax for street-paving on the abutting property. The court further decided that it is not necessary to publish the ordinance under which this assessment was made, as it is an ordinance levying a tax, and not for the appropriation of money, which latter only are required to be published.

MADISON, Wis., Feb. 6.—[Special.]—In the Senate to-day bills were introduced:

To secure liens to employés of contractors and sub-contractors.

To have highway taxes paid in money and put the business of roadmaking in the hands of a town overseer, the Railroad Commissioner to be ex-officio a State Highway Commissioner with general supervisory powers.

LINCOLN, NEB., February 3rd.—A large delegation of Omaha citizens, who are in the city, met with the Douglas County representatives at the Gorham this evening to discuss the needs of Omaha and the amendments to her city charter. Chairman Creighton, of the board of public work, Hon. G. W. Doane, Attorney Connell, County Clerk Leavitt and others were present. A number of important measures were considered and recommended:

1. That the city should have the right of eminent domain with respect to constructing sewers.
2. To extend the payment of sewer taxes to ten years.
3. That it shall require a petition of a majority of property owners to curb and gutter without paving.
7. Provision for taxing the property benefitted by sewers instead of on the feet frontage of abutting property.
8. Putting the power of constructing sidewalks entirely into the hands of the city.
9. Funding the city debt to the amount of $60,000 or $80,000.
10. Making more stringent the law prohibiting city officials from furnishing material to any city contractor or sub-contractor, and making fine and imprisonment the penalty.

The conference was in session about four hours and considered well all the proposed measures.

PUBLIC ROADS AGAIN.

The people in many parts of the country are again almost cut off from their local markets and isolated from society by the miserable quagmires, yclept public roads. Thousands, no doubt, are abusing the road laws, while profane thoughts are in their hearts, if wicked words do not find vent by way of their lips. This seems to be the proper season of the year for such things, but the spring will soon be at hand, and the time for putting the roads in *passable* condition so that they may pass the inspection of lenient grand juries will come with it.

It may not be amiss to again call the attention of road commissioners, overseers and citizens generally throughout the country to the fact that merely temporary work on the public roads does not pay. A few days' extra work done on a bad piece of road, in an intelligent manner, will save a vast deal of labor and annoyance in the future. It is almost useless to throw a few pine tops and a little dirt in a gully and leave it so that it will wash out and be worse than ever the next heavy rain that comes. Road officials ought to study road building, and learn how work done on the roads may be made permanent. The great point in securing good roads is drainage. Water should not be allowed to collect at any point on a road to do damage even during the heaviest rains. A little work done on properly drained roads every year will keep them in much better condition than a great deal of work on roads that are not properly drained or not drained at all.

It is the custom to abuse the road laws. No doubt they are defective, but if the road laws were enforced with intelligence there would be very little cause to complain of them. If commissioners and overseers would only learn their duties, and perform them according to the letter and spirit of the laws, and require road hands to do honest work, as if they were receiving wages in cash, the roads in nearly all parts of the country would be in pretty good condition at all seasons of the year.—Savannah, Ga., *Morning News*.

The Cost of Wood Pavements.

To the Editor of the Globe-Democrat:

It appears from the records and books of account at the City Hall that in 1860 the first of this pavement was laid by the patentee on Walnut between Main and Second streets; cost, $24 per square. It required repairs in about four years, and in 1867 it was relaid with white pine.

From 1863 to 1869 (inclusive) ten and one-tenth miles of this pavement was laid, costing $658,715.04. This amount was charged as a special tax against the owners of adjacent property, except eight blocks laid in 1869, which was paid for from the proceeds of the sale of the iron pavement removed. Repairs were commenced in 1867, being charged against the adjacent property owners.

In 1868 the City Council passed an ordinance directing that the repairs of Nicholson pavement should be paid for out of the general fund. Before this ordinance was passed $3,-264.87 had been expended and special tax bills issued for the same.

From December 1, 1868, to September 3, 1879, $390,069.92 was expended in repairing Nicholson pavement. After this last mentioned date, it is apparent that further efforts to renew this pavement as fast as it was worn out or decayed were abandoned; $76,545.69 was, however, expended in repairing the same before January 1, 1865, making altogether $473,144.68 expended for repairs; and construction account, makes $1,128,595.52 as the total amount which has been expended in the Nicholson pavement experiment in this city; about $65,-000 per mile for construction; about $45,000 for repair.

This is, in brief, the history of wooden pavements in this city up to the experiment with gum-wood blocks. Are they any better? In the report of the Street Commissioner for the fiscal year ending April 7, 1884, is the following:

"Reference has been made in the two last reports to the several pavements of treated gum-wood laid in this city. These pavements were laid, some in November, 1880, some during the seasons of 1881, and the last early in the year of 1882, so that the longest pavement laid is about three and one-half years, and the shortest two years.

"Most of these pavements will have to be renewed or taken up this year, and the remainder will not last longer than a year or eighteen months more.

"This result is somewhat unexpected, although it was remarked in last year's report 'that this wood swells when wet, forcing the blocks out of position, greatly impairing the integrity of the pavement.' This is the main cause, in my opinion, of the speedy destruction of these pavements. In every instance the rows of blocks across the street are found more or less warped and twisted out of position, caused by the swelling of the wood. This buckling of the blocks forces the separating strip to the surface, bringing with it all the cement and gravel in the joint. The blocks are loosened under these circumstances, when the wheels of passing vehicles in time force their way between them, and the pavement is ultimately broken up. The wood is fairly sound, except when sap-wood has been used, which invariably is found decayed. The blocks do not appear to resist wear under traffic any better, or perhaps not so well, as good white pine, as heretofore laid in Nicholson pavements."

This should be conclusive unless the city authorities are determined to indulge in another costly experiment. Respectfully,

P. C. BULKLEY.

St. Louis, January 31, 1885.

SHEET ASPHALT PAVEMENT.

As bearing upon the merits of sheet asphalt vements, we desire to submit a few communications that may be of public interest. The following letters, from officials of Buffalo and Omaha, were received by the Superintendent of our West Chicago Parks in reply to inquiries made relative to this pavement:

BOARD OF PUBLIC WORKS, OMAHA, NEB., NOV. 7, 1884.—In reply to your letter of the 27th ult., touching the results obtained from the use of Trinidad asphaltum as a paving material, I desire to say that we have about 150,000 yards of such pavement and as much more of stone pavement, and I can truthfully say that the Trinidad asphaltum has given us the *most perfect* satisfaction. It is a smooth, noiseless, hard and lasting pavement, and much preferable to stone for driveways. We are very much pleased with it in Omaha. Respectfully,

JAMES CREIGHTON,
Chairman Board of Public Works.

MAYOR'S OFFICE, BUFFALO, N. Y., Oct. 29, 1884. —Referring to yours dated 27th I beg to state that the asphalt pavement is in this city constantly gaining friends.

In my judgment, if honestly and properly laid, it is to be preferred to all others. We have here in immediate vicinity the best of stone paving material, but the asphalt is steadily gaining ground.

Wood with us was a perfect failure. Macadam is in limited use for park roads, but in the city proper is not used except to a very limited extent, and where used is of limestone, which is totally unfit for such use.

Any further information you may require please command my services. Yours,

JONATHAN SCOVILLE, Mayor.

The following is from an eminent authority who has been for eighteen years Superintendent of Streets of the City of Boston:

BOSTON, May 1, 1884.—*A. L. Barber, Esq.*—DEAR SIR: In answer to your dispatch asking information relative to the wearing qualities exhibited by the asphalt pavement in this city, I have the honor to say that Court Square was paved with Trinidad asphalt laid in accordance with the Washington specifications about four years ago. One side of the square is occupied with express-offices, and express teams heavily loaded are continually backed up to the sidewalk, yet, notwithstanding the twisting and turning of these teams and the very severe treatment to which the pavement is subjected on that account, not a single impression has been made upon the surface of the same. On the side next the court house I took the precaution to have granite blocks laid along the edgestone or curbing of the sidewalk, fearing that the continual passage of wheels would destroy the asphalt pavement if it was laid against the curbing. The result has surprised me, the granite blocks have been very considerably worn and grooved by the wheels running next the curbing, while the depression in the asphalt made by the outer wheels is barely perceptible. Kilby Street and Liberty Square were paved the same year, and the pavement on these streets, although subjected to very heavy travel and severe usage, is in as good condition as when first laid. From my observation of these pavements I am confident that a genuine Trinidad asphalt pavement properly laid in accordance with your specifications will stand heavy travel just as well as the granite block pavement. Yours very truly, CHARLES HARRIS, Superintendent of Streets.

We submit the opinion of Dearborn Avenue property-owners relative to this pavement:

To whom it may concern: The undersigned owners of property on Dearborn Avenue, north of Chicago Avenue, take pleasure in stating our entire satisfaction with the street asphalt pavement laid upon our street this last year by the Barber Asphalt Paving Company of Washington, D. C. We consider it for residence streets far superior to all others and believe that the value of property on Dearborn Avenue has been advanced at least $25 per foot by the laying of this pavement.

JAMES H. DOLE,	CHARLES A. DUPEE,
J. M. W. JONES,	ADOLPH LOEB,
S. E. EGAN,	FRANCIS B. PEABODY,
W. D. HOUGHTELING,	JOHN B. GROMMES,
S. O. EGAN,	H. F. LEWIS,
WILLIAM STEWART,	JOSEPH FLEISCHMAN,
HENRY SHUFELDT,	

And many others.

Very respectfully,
THE BARBER ASPHALT PAVING CO.

Chicago *Tribune*.

NEW GEORGIA, R. R.—It is said that all necessary arrangements for the commencement of the Silver Springs and Gulf Railroad will begin within ten or fifteen days. Interested parties are expected at Ocala this week, when a final settlement of matters will be known. The stockholders of the company have decided in favor of the Cotton Plant route, and the course of the road from there will be a direct route to the Gulf. The work is expected to be completed in time to move a large portion of Marion's produce next season.

The Cost of Bad Roads.

Whenever a proposition is made to improve the public highway in any town or part of the country, plenty of people are ready enough to figure on the cost of the proposed improvement. Too often the figuring is all that is done, for, as these people are able or willing to see only one side of the proposed work, they succeed in preventing the carrying out of any plan for making better the roads in common use. Missouri is fortunate in having for Professor of Agriculture, at Columbia, a man who is determined that the farmers, in that State at least, shall know what it costs them to drag loads over bad roads. To this end he has made a number of experiments to ascertain just what the difference is between the force required for pulling a load of given weight over different kinds of roads, and to show the value of broad tires, especially in farm work. The results are given in a pamphlet of a dozen pages, illustrated by eight diagrams.

Each load drawn was of 3,695 pounds. The tires of the wheels were respectively one and a half and three inches wide, the narrower ones being considerably worn. On a blue-grass sward, moist, although but little rain had fallen within twelve days of the time of making the test, the average force required by the broad tires was 310 pounds; the narrow ones required 439 pounds, or 41.6 per cent. more than was required by the others. Professor Sanborn says:

"Assuming the wagon to weigh 1,000 pounds, then on the broad wheels 3,248 pounds of load would be drawn as easily as 2,000 pounds on the narrow tires, except the loss from the wheels cutting deeper under the heavier load. Again, the broad wheels in the trial did not injure the turf, while the narrow wheels cut through it, an important consideration. Our teamsters, for use about the college farm, invariably choose the broad wheels. They find that they are not nearly as liable to get stuck in soft places, or during rainy times.

"In a subsequent trial on a partially dried dirt road, the broad wheels cut the road less deeply, and drew easier than the narrow wheels, the draft being for the broad tires 371 pounds, and for the narrow tires 441 pounds, or the latter drew 12.7 per cent. heavier than the former, a net difference per ton load of 381 pounds, or 381 pounds more could be drawn on the broad wheels to the preservation of roads, as is recognized in two or three States by adjusting the rate of toll to the width of wheels, the tolls being remitted on wheels of a certain width. The difference of draft above recorded disappears on good roads.

"In the tests for ascertaining the difference in draft on good and poor roads, ordinary narrow tires were used. The road had a gravel bed. The first pull was up a grade 1 foot in 28 feet, and the draft was 310 pounds. This test was made on grass, and shows that narrow tires on grass, a few days after a rain, are equivalent to a draft up a hill of more than 1 foot rise to 28 feet.

"The second pull was on a flat at the top of the above grade, and drew on a draft of 118 pounds. This should enforce the importance of avoiding hills, and of reducing grades, when practicable, by leveling. The net load drawn would be hardly one-third as much up this mild grade as on level ground. In addition to this loss there is the further loss of capacity of a horse to draw up-hill. It is well known that the structure of the horse is such that he works to a disadvantage up a grade. On level ground man-power is as one to five, but up-hill as one to three compared with the horse.

"The value of grades is well known to railroads, and it has sometimes caused their reconstruction or the building of competing lines, and in the older parts of our country the country roads are often reconstructed at great

cost for the business advantage of improved grades."

On a moist dirt road the draft was 487 pounds, or 57 per cent. more than required on a grade of one to twenty-eight feet on a gravel road, four times as much as required on a level road, and seven times as much as required on a level plank floor.

The draft registered by no means shows the actual effects on the horses, as it does not take into account the suction of the mud and the slipping of their feet, nor the extra effort required for lifting their feet over the little elevations constantly before them. Prof. Sanborn concludes by saying:

"As we view the long periods in which traffic is suspended on our dirt roads (generally in periods when farmers are not busy), the small loads dragged into our markets, the value of which is largely absorbed by the expense of delivery; the almost universal use of the saddle horse, and the immense loads carried on the solid roads of much of Europe, in connection with the above tests, we are not likely to overestimate the profound relation of our miserably crooked and marly roads, bridgeless creeks, and hills, neither graded nor circumvented, to our system of farming, its profits and pleasures.

"From the above tests, the traffic that will warrant a $2,000 outlay per mile of unimproved roads may be approximately estimated. If by properly grading our hills and graveling our road-beds we can double the freight carried per team, we could on the basis of fifteen miles per day for a loaded team costing $3 per day, save the interest of this cost at 6 per cent. in the passage of 600 loaded teams each way."

Shipping Iron North.

The Ocean Steamship Company between Savannah and New York and Philadelphia is carrying large quantities of pig iron from this port North, and the trade is increasing. The iron is from the Alabama and Tennessee, mines, most of it being from Birmingham, and is transported by rail to this city and then by steamer to New York and Philadelphia. The freightage is $3.80 per ton for the entire trip from the mines to the market.

Contracts for carrying iron to New York and Philadelphia, were entered into last September and the steamers to New York since then have been carrying about 800 tons a week. The Philadelphia steamers have carried North 3,468 tons of ore, and are now transporting about 350 tons a week.

Gen. G. M. Sorrel, agent of the Ocean Steamship Company, stated to a *News* reporter yesterday that he had just entered into a contract to transport 6,000 tons of pig iron to Philadelphia. He said that the furnaces of Alabama and Tennessee were doing a good trade with Northern points, and already the demands upon the company by the furnaces have commenced to tax their capacity. With a greater tonnage to devote to this class of transportation he had no doubt they could do a larger business.

The iron trade of the South is entering into direct competition with the great iron-producing fields of Pennsylvania, and is putting large quantities of the product into her principal city. The superior quality of the ore mined in Tennessee and Alabama has long been recognized. It equals the Swedish iron, which is said to be the best in the world, in ductility and firmness of texture, and has attained a high place in the iron market. Already Alabama and Tennessee control the iron markets of Illinois and Indiana, both of which are large consumers. Pig iron is now being transported from Birmingham, Ala., to Indianapolis, Ind., for $3.75 per ton, and from Tennessee for a little less.—Savannah *Morning News*, 7th.

The Canadian Pacific Bubble.

A pamphlet was issued at Ottawa last week, signed "Philo Veritow," but known to have been written by a prominent civil engineer, who has been so situated as to know whereof he writes, in which statements of the most damaging character are made against the Canadian Pacific and the Government. The writer asserts that the company has never reported to the Minister of Railways, as required, but has always done the opposite, and no accurate account has ever been kept of the expenditure of the large advances made by Parliament. For the change of location of the route west of Winnipeg, Van Horne, the General Manager, was responsible, as well as for the extraordinary rate at which the line was built across the prairie. The report states that Van Horne's income amounts to from $40,000 to $60,000, Stephen, the President, getting $20,000, and Angus, Vice President, $15,000. The writer also says that additional assistance will be asked by the syndicate at the approaching session, notwithstanding the $32,000,000 loan of last year. Accounts and reports are dragged unwillingly from the company, and have no parallel in the history of modern railways, facts being deliberately suppressed. There is no statement given as to the grades or curves, and the accounts are unintelligible documents. The cost of the road west of Winnipeg was shown by Sandford Fleming to be $13,000 per mile, yet the syndicate shows the amount to be $16,000. The grades near Kicking Horse Pass run from 200 to 300, although it was arranged that they should not reach 116. The route through the Selkirk Range is said to be impracticable, as it was a domain of glaciers. In the abandonment of the Algo branch, which is now a total wreck, the company lost nearly $2,000,000. The connecting of British Columbia with the rest of the Dominion by railway could only be a political move and not in the interest of trade, since it should find an outlet on the Pacific coast. The idea that trade can be got from Japan and China is said to be silly, since no trade exists. No one credits that a nine-mile tunnel through the mountains will ever be built, and the road, now called temporary, is really permanent. The writer shows that really $10,000,000 more have been put in the line than stated by the company, and that a bonus will be asked for constructing the road from Sudbury to Sault Ste. Marie. The appearance of the pamphlet has caused considerable excitement in railroad circles, and some attribute its existence to the Grand Trunk.—[From the Boston *Advertiser*.]

The Chain of Rocks Bridge Company.

The following is given as the stock apportionment of the Chain of Rocks Bridge Company, the capital stock being $2,000,000, divided into 20,000 shares at $100 each. It will be seen that a very large majority of the stock is in the name of A. F. Hoffer:

	Shares.	Value.
William Glasgow, Jr.	10	$1,000
J. L. Ferguson	100	10,000
W. L. Hickman	2	200
J. E. Gibson	5	500
H. B. Evans	1	100
John T. Walter	1	100
Jacob Billnes	2	200
A. H. Edwards	1	100
Frederick Shickle	100	10,000
Thomas Howard	100	10,000
John W. Harrison	50	5,000
Erastus Wells	50	5,000
Joseph P. Card	100	10,000
A. F. Hoffer	19,478	1,947,800
		$2,000,000

St. Louis *Globe Democrat*.

THE Montgomery Street Car Company has completed its organization. The capital stock is $40,000. The iron already bought for two miles and a half of track, four cars purchased, deliverable in thirty days, and work begins immediately.

SELECTED MISCELLANY.

TESTS have proved that one pound of powder in small blasts will loosen about 4½ tons of rock, and in large blasts about 2¾ tons. In a day of ten hours one man can bore with a bit an inch in diameter from 50 to 100 inches deep in granite, or from 300 to 400 inches in limestone.

Sextuplex Telegraphy.—Mr. Selden, Superintendent of Baltimore and Ohio telegraphs, whose headquarters are at the central company building, is the inventor and patentee of a sextuplex instrument, which has been adopted by the Baltimore and Ohio Company. Three messages can be sent simultaneously from each end of a single wire, and every word comes distinctly.

DUMONT'S sewerage scheme for Paris contemplates the construction of a drain about 100 miles long from the city to a covered reservoir below Herblay on the right bank of the seine, and between Dieppe and Treport, and the establishment of pumping stations at Eragny and Serifontaine. It is estimated that for nine months of the year almost the whole of the sewage will be taken up by irrigation. The entire cost of construction is expected to be not more than $12,000,000, and it is anticipated that the maintenance of the pumping stations will be fully secured by the sales of the sewage for irrigation purposes. Only during one-quarter of the year will much of the waste of the French metropolis reach the sea at all.

THE timber business on our river is growing to immense proportions and is the source of a large revenue to Decatur county. A large number of men now find employment therein, and gradually the eyes of the building world are turning towards us. Our county supplied the bulk of the heavy timbers used in the construction of the Brooklyn bridge, between New York city and Brooklyn, and its superior quality and extraordinary size is a standing advertisement for us in the Western metropolis of the world. There are millions in the timber of our country, and the only lack of the times is capital to unlock this treasure. Our advice to land-owners, therefore, is to stop the butchery of the timber by turpentineries and hold on to them, and the timber on them. There is a fortune in Decatur county pine lands in the near future.—Bainbridge, Ga. *Democrat*.

A NEW form of apparatus for determining the compressibility of water has been exhibited by Prof. Tait before the Royal Society, Edinburg. Instead of measuring the compression caused by a given pressure he now measures the pressure required to produce a given compression. His new arrangement allows him to make any number of measurement in rapid succession at any one temperature; and then the temperature can be raised and corresponding measurements made without once opening the compression apparatus. Experiments which formerly would have taken weeks for their completion could now be accomplished in an afternoon. He hopes to demonstrate, as soon as he has a practical working specimen of his invention at his command, that the diminution of compressibility at higher pressure becomes less at higher temperatures, and may even become an increase for the first few hundred atmosphere s pressure.

THE GREAT RIVERS OF THE WORLD.—The combined length of the Mississippi and Missouri Rivers is 4,506 miles; that of the Amazon and its longest tributary is about 4,000 miles. The Hoang-Ho in China is estimated at 3,000 miles; the Murray River in Australia at 3,000; the Nile at 3,300; the Obi in Asiatic Siberia at 3,000; the Yangtse-Kiang in China at 3,000. The Amazon is entitled to be called the greatest river in the world. It drains—with its tributaries—an area of 2,330,000 square miles and is navigable 3,360 miles. The volume of water it carries is the greatest of any river on the globe with the exception of the St. Lawrence, which comprises the chain of lakes. At its mouth the Amazon is 150 miles wide; its average width is 2 miles. The average width of the Mississippi is 3,000 feet; that of the Missouri 800 feet. The Murray, Nile and Obi respectively 500, 500 and 350 feet wide, while the Yang-tse-Kiang is 1,000 feet in width. The Mississippi and Missouri combined are navigable 3,950 miles; the Mississippi alone, 2,200 miles. The depth of the Mississippi is from 75 to 120 feet. No accurate measurement of the depth of the other rivers named has been recorded.

No recent discovery has been made of a lake claimed to be the source of the Mississippi River. "L. T. N." probably has in mind the recently reported discovery of a large lake in Canada, which bears a somewhat similar name—Mistassini. This lake is situated many hundred miles to the northeast of Itaska and the head waters of the Mississippi and finds its outlet into Hudson Bay. The lake has long figured in the maps, the alleged "discovery" being that it is of very much larger size than previously supposed. The fact is disputed.—Cleveland *Herald*.

THE Committee on Hoosac Tunnel Mass. Legislature will give a hearing to parties interested in the petition of John C. Newton for authority to build a railroad from the eastern portal of Hoosac tunnel and co-operate the same in connection with the Troy & Greenfield railroad, at the State Hoosac, on Thursday, February 12, at 11 o'clock A. M.

Engineering News

AND

AMERICAN CONTRACT JOURNAL.

Tribune Building, - - - New York City.

THE ENGINEERING NEWS PUBLISHING CO. PROPRIETOR.

PUBLISHED EVERY SATURDAY.

CONDUCTED BY

GEO. H. FROST, - - - Assoc. Am. Soc. C. E.
D. McN. STAUFFER, M.Am.Soc.C.E.: M.Inst.C.E.

TERMS OF SUBSCRIPTION:

$4.00.....PER YEAR TO U. S. AND CANADA.
$5.56..... " " " FOREIGN COUNTRIES.

CLUBBING ARRANGEMENTS.

In order to accommodate such of our subscribers as may wish to subscribe for other periodicals, we offer the following terms: We will send to any address ENGINEERING NEWS at regular subscription price, $4.00 and the following at the additional prices given:

	Net. Price.	Reg. Price.
Atlantic Monthly	$3.25	$4.00
Century Magazine	3.55	4.00
Harper's Magazine	3.25	4.00
Harper's Weekly	3.25	4.00
Harper's Bazaar	3.25	4.00
Harper's Young People(weekly)	1.65	2.00
Popular Science Monthly	4.25	5.00
St. Nicholas Magazine	2.55	3.00
North American Review	4.10	5.00

TABLE OF CONTENTS

	PAGE
The Tehuantepec Ship Railway (*Illustrated*)	97
Transporting Explosives	100
The Purification of Water by Iron	100
Rock-drills Run by Electricity	101
Motive Power from Hydrant Pressure	101
Wire Ropes for Heavy Cranes	101
Streets and Roads	101
The Cost of Wood Pavements	102
The Cost of Bad Roads	102
Shipping Iron North	103
The Canadian Pacific Bubble	103
The Chain of Rocks Bridge Company	103
Selected Miscellany	103
Finding a Bore Hole	104
The Chronology of the Water-jet as an Aid to Engineering Construction	104
The Washington, D. C. Aqueduct	105
Correspondence	107
Literature	107
Trautwine's Civil Engineer's Pocket Book	108
Track	209
History and Statistics of American Water Works	109
Water	110
News of the Week	111
Government Notes	112
Market Report	112

Finding a Bore Hole.

In our issue of Jan. 31 an article with the above title was quoted from London *Engineering*, describing the successful use of a magnet in finding a lost bore hole. A Mr. E. F. Macgeorge has since written to *Engineering* that he suggested the same method in a similar predicament in Australia, but failed because the drill had deviated far beyond the limits of magnetic influence. So quotes the writer:

The search operations were continued for nearly twelve months at a cost of 3663*l*., but neither the bore hole nor the golden stone pierced by it could be found; when I suggested the employment of glass phials filled with melted gelatine, which were let down the bore and allowed to congeal. A compass needle in a lower bulb of the phial had been "frozen in" while pointing to the north, and the surface of the gelatine had "set" while level; and these two indications served to show the inclination and magnetic bearing of the deviated bore hole at that part. Repeating this operation at convenient depths successively, the mysterious and erratic bore hole was completely mapped from top to bottom, and showed a deviation of nearly 40 feet at 370 feet (the part so long searched for), while at the full depth of 500 feet the deviation indicated 70 feet to 80 feet. A fortnight's hard driving straight for the indicated spot revealed the lost bore hole 37½ feet away from where it should have been, while the bottom proved to be 75 feet astray! Clearly magnets in the bore hole would not have availed here, as at Edinburgh, with only 8 feet deviation at 200 feet, and I regarded my apparatus as worth patenting and perfecting, which, after two years' assiduous labor and study, has been done; and the apparatus may be seen by those interested in mines and diamond drills in this city at your office if you desire.

In another mine in which it has been applied, the bore hole was found to have erred 30 feet, and the Victorian Goverment soon afterwards adopted the invention as being "an indispensable adjunct to the diamond drill." For it may be safely asserted that it is impossible for a drill to go straight; therefore its path must be surveyed, to be of any use.

The Chronology of the Water-jet as an Aid to Engineering Construction.

In our first issue of this year we gave, from a correspondent, a sketch of the discovery of the water-jet as applied to sinking piles, giving credit to Lieut. W. H. Stevens, as the discoverer, and 1859 as the date. Our attention has since been called to a pamphlet on this subject by L. Y. Schermerhorn, C. E., under the direction of Major Henry M. Robert, U. S. Eng's, and published by the Engineer Department in 1881.

Mr. Schermerhorn has carefully studied the use of the water-jet as an aid to engineering construction, and from his compilation of methods concerning its application we condense the following:

Its use first arose from the difficulties experienced in securing suitable foundations for light houses and wharves on the sandy shores of the Gulf and South Atlantic States. According to the examination on which the report quoted was based, the earliest determined use of the jet occurred in 1852, in sinking piles for a wharf at Decrow's Point, Matagorda Bay, Texas. It seems to have arisen from a suggestion made by Lieut. Geo. B. McClellan U. S. E., then Chief Engineer of the Department of Texas. As there applied, according to an eye-witness, an ordinary hose with a gas-pipe nozzle was placed close to the point of the pile, and water was forced by a hand-pump through the pipe, and the pile rapidly sunk into the sand.

In 1854, Mr. Chas. Pontzen, suggested the use of this appliance in sinking piles for the foundation of Pungateague Light, Chesapeake Bay. These piles were cast iron, 18 feet long and 7 inches in diameter with a trumpet-shaped base flaring out to 3 feet diameter. A 1 inch pipe passed through the pile and was connected by a hose to a hand force-pump. By this means a pile was sunk 11 feet in 2½ hours; 11 piles were sunk in 3 days.

Between 1854 and 1861, Lieut. W. H. Stevens U. S. Eng's, used the jet for sinking sheet and bearing piles in jetty construction at Fort Livingston, La.; in sinking wooden piles and screw piles for a light house at Half Moon Shoals, Matagorda Bay, and at other places. The detail of application is not given, but the data obtainable would indicate that the jet was not attached to the piles.

In 1856, James Brunlees used the water-jet as an aid in sinking cast-iron piles for the foundations of the Kent and Leven Viaduct, England. The piles were hollow, pointed and provided with a disk near the lower end. A wrought-iron 2 inch pipe was carried down inside the pile and 2 feet below the point; power was supplied from a force-pump.

In 1862, 5000 wooden piles, from 20 to 30 feet long and 18 to 30 inches in diameter, were sunk by this method by D. W. Glenn for obstructing the entrance of the Federal fleet into Mobile Bay, Alabama. This process is described in full in *Van Nostrand's Magazine*, page 360, 1874.

In the Gulf States palmetto piles are found to effectually resist the ravages of the *teredo navalis;* but as the wood is too soft to permit driving by the ordinary hammer, the water-jet has been successfully applied in sinking them. Application of the principle was made in 1872 by Maj. P. C. Hains at Thimble Light, Va.; in 1873 by Capt. A. N. Damrell at Fort Gaines, Mobile Bay, and in 1877 at Fort Morgan, Mobile Bay, and in 1874-5, by Capt. C. E. L. B. Davis in placing sheet piling in Galveston Bay, Texas.

From 1867 to 1869, O. Chanute, C. E., Chief Engineer of the Kansas City Bridge, used the water-jet in sinking wooden bearing piles, by passing an iron pipe along the pile to its point. Mr. Chanute also used compound piles by bolting four square pieces of timber together, and leaving a central hole by chamfering the inner corners of the four piles.

In 1868, Mr. T. J. Whitman, Chief Engineer of the St. Louis water-works, applied the water-jet to sinking sheet-piling for the coffer dam about the foundations for the river engine. A 2-inch pipe, contracted to a ¾ inch opening at end, was fastened to the side of the pile with the end bent so as to bring the nozzle just to the point of the pile, when water was forced in by a 3 in. hose. A second method of application was to bore a hole 2 feet deep from the point of the pile upwards on its axis, and the pipe was applied to a second hole bored obliquely from the side of the pile to intersect the first. Most rapid progress was made by the second method.

In 1870, E. D. Mason, C. E., used the water-jet at the Hannibal Bridge to clear away the sand from the piles so that they might be cut off.

In 1871, Capt. M. R. Brown, U. S. Eng's, applied the jet in sinking iron screw-piles for the pier at Lewes, Delaware Bay. These piles were wrought-iron, 5½ to 8½ inches diameter with cast-iron screws 2 and 2½ feet in diameter. In attempting to screw the piles down by powerful levers they broke off from the extreme resistance of the material. The attempt to reduce resistance by leading a water-jet *beneath* the screw, failed from the insufficient power of the pump and the prevalence of gravel. An examination of a broken screw led to the conclusion that the greatest resistance was due to the direct weight of the superimposed cone of sand on the upper surface of the screw. Streams of water from two 1¼ inch pipes were then led directly upon the tops of the flanges and the piles were put down with comparative ease. The fact was developed that nine-tenths of the resistance disappeared when the jet was applied above the flange, and where the piles could not be forced down by any power applied to levers more than 4 feet, the jet properly applied made it possible to sink them 20 feet with little difficulty. Some of these screw-piles were easily removed by the applications of the jet in the same manner when all other methods failed.

In 1873, C. C. Martin, C. E., Superintending Engineer of the East River Bridge, applied the water-jet to sinking sheet piling, as follows; Sheet-planks were 8 by 2 inches, and it was found that 30 to 40 blows were required to drive a plank one inch. A ¾ inch pipe 3 feet long was then attached to a ¾ inch hose, and the pipe was inserted alongside the plank; with a water pressure of about 50 lbs. per square inch, obtained from the city mains, then the plank was easily driven. As a comparative test, it was found that sheet-plank, without the jet required 392 blows to drive it 10 inches in 18 minutes, while by the aid of the jet a similar plank required only 93 blows to drive it 17½ inches in 2 minutes.

In 1874, G. Jordan, C. E., in building the piers for a bridge over the Tensas River, Alabama, sunk iron cylinders, from 4 to 6 feet diameter, by using a series of jets applied concentrically with the inner side of the cylinders.

In 1875, C. Fitzsimons applied the water-jet to ease the resistance from sand pressure against the brick shafts of the Fullerton Avenue conduit, at Chicago.

In 1877, Stoklin & Vetelart, contractors for the enlargement of Calais Harbor, France, used the water-jet in combination with an ordinary pile-driver as follows:—Guide-piles 9 inches square and 6½ feet apart were driven 10 feet into the bottom; between these 4 inch sheathing plank was driven to a depth of 8 feet. The water was injected from two vertical pipes, one on each side of the pile, and project-

TABLE No. 1.

Number.	Names and addresses of bidders.	Coping masonry, 1,125 cubic yards.	Cut-stone masonry, 1,550 cubic yards.	Concrete masonry, 2,000 cubic yards.	Stone filling in cribs, 460 cords.	Riprap backing, 475 cords.	Clay and gravel backing, 1,000 cubic yards.	Pine timber and plank, 175,000 feet, B. M.	Oak timber, 3,800 feet B. M.	Wrought-iron bolts and cramps, 50,000 pounds.	Spikes and nails 2,560 pounds.	Excavation, 1,800 cubic yards.	Area to be cleared, 8,000 square yards.	Aggregate cost of items in approximate bill.	Remarks.
1	J. H. Dewees & Co., Washington, D. C.	$39 55 40 50	$31 00 10 00	$4 75 4 75	$12 00 3 00	$10 00 3 00	$0 75 75	$39 00 39 00	$49 00 49 00	$0 07½ 7½	$0 04¾ 4¾	$2 00 2 00	$0 15 15	$130,054 50 91,198 25	Dam complete, using Cape Ann and Berea stone, Connecticut. Dam complete, using Seneca stone, Government quarry.
2	Chittenden Brothers, Washington, D. C.	32 00 24 50	25 75 20 75	5 50 5 50	6 50 6 50	7 25 7 25	1 00 1 00	45 00 45 00	75 00 75 00	7 7	6 6	1 00 1 00	5 5	110,481 25 94,293 75	Dam complete, using Leetes Island granite quarries. Dam complete, using Seneca stone Government quarry.
3	Stephens, Gere & Co., Syracuse, N. Y.	30 00 29 75	16 00 15 75	6 00 6 00	12 50 2 50	12 00 2 50	1 00 1 00	45 00 45 00	55 00 55 00	10 10	10 10	1 50 1 50	75 75	106,515 00 96,833 75	Dam complete, using Seneca quarry above the falls. Dam complete, using Seneca quarry, (less royalty).
4	Henry L. Cranford, Washington, D. C.	45 00 40 00	39 00 34 00	6 00 6 00	9 00 9 00	9 00 9 00	1 50 1 50	40 00 40 00	50 00 50 00	5 5	6 6	1 00 1 00	10 10	146,800 00 133,425 00	Dam complete, using Mill Stone Point. Dam complete, using Seneca stone, Government quarry
5	Charles Hart, Brooklyn, N. Y.	40 00 30 00	35 00 24 00	6 00 6 00	18 00 18 00	12 00 12 00	3 00 3 00	160 00 160 00	160 00 160 00	10 10	6 6	30 30	10 10	167,820 00 139,520 00	Dam complete, using State of Maine quarries. Dam complete, using Seneca stone Government quarry.
6	John Beattie, Leetes Island, & Connecticut.	34 75	28 40	10 50	8 60	8 10	2 25	94 50	98 50	16	10	95	20	145,429 25	Dam complete, using granite quarries in Leetes Island Connecticut.
7	Humbird & Morgan, Cumberland, Md.	50 00	48 00	6 00	12 00	15 00	2 00	150 00	150 90	4	4	1 00	50	196,275 00	Dam complete, using Mount Waldo Granite Works.
8	Hoopes Artificial Stone Co., Baltimore, Md.	14 00	.....	.....	4 00	4 00	3 00	60 00	60 00	5	5	99	6	.....	Dam complete, using Hoopes beton Coignet.

Contract awarded to Chittenden Brothers, dated November 7, 1883.

ing 1 foot below the bottom of the pile. Without the jet, a 1200 lb. hammer falling 6 feet gave 185 blows in driving a guide-pile 10 feet and 900 blows in driving a 6½ foot panel 8 feet, in 8 hours and 36 minutes. With the jet a panel was driven home in 1 hour and 9 minutes with from 0 to 50 blows of the hammer. This system permitted a closer placing of the sheeting than was possible with the hammer.

During 1878-80, Major H. M. Robert, U. S. Eng's employed the jet in placing sand-tight sheet-piling in the harbor protection works on Lake Michigan.

About 1880, C. Macdonald, C. E., applied the water-jet in building the iron-pier at Coney Island. The piles were hollow, of wrought-iron and 8⅝ inches diameter, with cast-iron disks 2 feet in diameter and 9 inches deep; they were sunk from 10 to 17 feet in the sand. The water was injected through the pile and disk and about 2 inches beyond the point. The power was supplied by a Wilmington pump, with 12 × 8½ inches steam, and 8½ × 7½ inches water cylinders. The piles were driven in clear sand at the rate of 3 feet per minute to a depth of 12 feet; after that the rate diminished, and beyond 18 feet the progress was very slow. It was found later that the piles could be sunk more rapidly by pumping directly through the hollow pile, instead of an inner pipe; the bottom of the pile had a 2-inch opening.

On Diamond Reef, in New York Harbor, the water-jet was used to remove deposits of clay and imbedded boulders. Water was projected from a 2½ inch hose with a 1¼ inch nozzle under 150 lbs. pressure. The nozzle was attached to spars and forced downward into the material. The nozzle penetrated 1 foot per minute to a depth of 5 or 6 feet, and made a cavity from 3 to 5 feet in diameter; the sand and clay were washed away and the stones sank to the bottom. Boulders 10 feet in diameter, and 7 feet thick were thus undermined and sunk below the required depth, or removed.

ONE of the handsomest and most unique and original ideas in Chromo-lithography is the Columbia Valentine, just issued by the Pope Manufacturing Co., of Boston, Mass. The design is in twelve colors, from a painting by Copeland, of Boston, is mounted on a panel, and is a genuine work of picturesque art, representing, in three scenic sections, the morning, noon, and night of 'cycling.

The Washington, D. C., Aqueduct.

We are indebted to the courtesy of Capt. T. W. Symons, U. S. Engineers, for the annual report of Maj. G. J. Lydecker, Engineer Commissioner, on the Aqueduct Tunnel now under construction for the increased water supply of Washington, D. C., and for the progress notes on the tunnel since July, 1884.

The work upon this tunnel is being done in pursuance of an act approved July, 15, 1882, "to increase the water supply of the City of Washington." The project consists, first, in the extension of the Washington Aqueduct from the distributing reservoir to the site of a new reservoir near Howard University. (See map in ENGINEERING NEWS Feb. 16, 1884,) by a tunnel 20,715$^{8}_{10}$ feet long; second, the completion of a dam above the Great Falls, entirely across the Potomac, to a height of 148 feet above mean high tide at the Washington Navy Yard; third, the construction of a new distributing reservoir in a valley east of the Howard University, of a capacity of about 300,000,000 gallons; and, fourth, the laying of cast-iron mains, 75 and 48 inches in diameter, from the new reservoir to the heart of distribution.

In October, 1883, contracts were let for the tunnel, dam and reservoir at prices which make the estimated cost of the general work as follows:

Dam	$94,293.75
Tunnel	548,100.00
Reservoir	298,980.00

Active operations were commenced under these contracts in November 1883. The laying of mains was commenced in May by hired help, and by Jan. 1, 1884, 3,600 lineal feet of 48 inch main had been completed.

There were seven bids for the tunnel, fifteen for the reservoir, and eight for the dam, under the proposals invited August 29, 1883. On Oct. 29, 1883 the tunnel construction was awarded to Beckwith & Quackenbush, at prices (exclusive of tunnel lining, the extent of which could not be estimated) aggregating $548,100. On Oct. 30, 1883, the reservoir was awarded to Maloney & Gleason at prices given above. On Nov. 7, 1883, the construction of the dam was given to Chittenden Bros. as stated.

The Dam at the Great Falls.—This work involves the construction of a masonry dam, 1,843 feet long, with a general height of 4 feet across Conn's island; and maximum height of 20 feet in the deep channel on the Virginia side. In addition to this the present dam is to be raised to the required elevation by a coping 15 inches thick over a length of 1,034 lineal feet. By a supplemental contract the deep water channel has been reduced in width from 450 to 250 feet, and a masonry structure substituted for the original crib dam. The work has been vigorously pushed, and the estimate of work done to June 30, 1884 shows $21,926.70 paid to the contractors. Table No. 1 gives the abstract of proposals received and opened October 5, 1883 for the construction of the Great Falls Dam.

The Tunnel. The tunnel is located upon an air-line between the points named; its length is 20,715$^{8}_{10}$ feet, and its cross-section is 11 feet wide by 7½ feet high. Four working shafts are used, as follows:—Foundry Shaft, opened Dec. 12, 1883, 69 feet deep to tunnel grade; Rock Creek, opened Dec. 13, 58½ feet deep; Champlain Avenue, opened Dec. 14, 137½ ft. deep; East Shaft (at new reservoir) opened Jan. 2, 162 feet deep; and West Inlet Shaft (at old distributing reservoir) 97 feet deep. With the exception of a short section at inlet shaft, the entire tunnel is in hard, solid rock. The rock excavation in the shafts was, as a rule, done by hand; in the tunnel all excavation is by Ingersoll "Eclipse" rock-drills, run by compressed-air carried to the workings by pipe lines, from 12 to 4 in.; from a central air-compressing plant (See ENGINEERING NEWS Feb. 16, 1883). The pipe-line for this purpose is 24,195 feet long, and by the time the tunnel is completed about 10 miles of this pipe will be required; this will be the greatest distance to which compressed-air has ever been carried in this country.

The compressed air plant is located at a central station near the mouth of Rock Creek, and directly upon the Chesapeake and Ohio Canal (where coal can be delivered at a minimum of cost), and consists of four Ingersoll, direct acting, "Straight Line," air-compressors, having steam and air cylinders of 24 inches diameter, by 30 inches stroke, which compress the air to 65 @ 70 pounds per square inch, and running at the average speed of 80 revolutions furnish 3756 feet of free air per minute, (actual). Power is supplied to run the compressors, by six return tubular boilers, furnished by the Ingersoll Co.; each boiler is 66 inches in diameter, and 14 feet long, the six boilers being set in a battery located in the same building and so arranged that steam may be cut off from any one or more of the boilers at will. The air from the compressors

TABLE No. 3.

No.	Names and addresses of bidders.	Excavation in tunnel, 64,600 cubic yards.	Earth excavation in shafts 1,500 cubic yards.	Rock excavation in shafts 1,200 cubic yards.	Tunnel lining. Brick masonry, amount unknown per cubic yard.	Tunnel lining. Concrete masonry, amount unknown, per cubic yard.	Tunnel lining. Dry stone packing, amount unknown, per cubic yard.	Brick masonry in shafts, 250 cubic yards.	Concrete masonry in shafts, 660 cubic yards.	Dry stone packing in shafts, 400 cubic yard.	Air shafts complete, 420 linear feet.	Aggregate cost of items in approximate bill.	Tunnel lining that may be placed with balance of appropriation.
													Cu. yds.
1	J. H. Dewees & Co., Washington, D. C.	$ 6 74	$ 6 25	$12 40	$10 00	$ 5 00	$ 2 00	$12 00	$ 5 00	$ 2 00	$ 4 75	$464,710 00	25,280
2	Eugene Robinson, Detroit, Mich.	7 78	5 60	16 24	12 80	8 55	1 00	16 70	13 75	2 25	2 25	540,903 00	7,329
3	Beckwith & Quackenbush, Mohawk, N. Y.	8 00	6 00	10 00	14 00	5 00	2 50	18 00	5 00	2 50	15 00	548,100 00	8,455
4	Dowling, Kennedy & Co, New York, N. Y.	10 00	4 00	15 00	12 00	5 50	2 50	12 00	5 50	2 50	5 00	673,730 00	None.
5	Henry L. Cranford, Washington, D. C.	9 90	10 00	12 00	20 00	4 00	1 00	15 00	4 00	1 00	10 00	676,990 00	None.
6	Stephens, Gere & Co., Syracuse, N. Y.	10 50	15 00	15 00	12 00	12 00	2 50	12 50	6 50	2 50	5 00	723,015 00	None.
7	James Archbald, Scranton, Pa.	11 25	7 00	17 00	15 00	10 00	2 00	15 00	10 00	2 00	20 00	770,450 00	None.

TABLE No. 4.

Number.	Names and addresses of bidders.	Excavation, 695,000 cubic yards.	Puddling, 54,000 cubic yards.	Sodding 20,000 square yards.	Cut-stone masonry, 12 cubic yards.	Brick masonry, 250 cubic yards.	Concrete masonry, 3,500 cubic yards.	Rubble masonry, 100 cubic yards.	Trap-rock lining in cement, 1,400 square yards.	Broken-stone lining, 8,000 cubic yards.	Paving, 80,000 square yards.	Coping, 98 linear feet.	Cast-iron drains, 3,100 linear feet.	Aggregate cost of items in approximate bill.
1	Maloney & Gleason, Washington, D. C.	$0 30	$0 40	$0 20	$15 00	$9 00	$5 50	$6 00	$1 00	$2 00	$0 28	$5 00	$0 75	$298 980 00
2	Gilbert Peterson, Lockport, N. Y.	28	11	30	10 00	9 66	4 20	4 60	3 00	1 00	1 08	2 50	12	323,512 50
3	Robert S. Johnson, Trenton, N. J.	33	66	45	12 00	12 00	3 00	2 00	1 45	1 25	50	6 00	20	341,054 00
4	Dowling, Kennedy & Co., New York, N. Y.	24	1 00	25	25 00	13 00	5 50	7 00	4 00	2 00	1 00	2 00	40	352,335 00
5	James Archbald, Scranton, Pa.	33	40	30	15 00	12 00	5 00	6 00	2 00	2 50	75	3 00	50	362,865 00
6	Eugene Robinson, Detroit, Mich.	29	82	32	20 00	13 52	9 59	3 00	1 15	2 10	80	4 00	38	373,683 00
7	John W. Rutherford, Hoboken, N. J.	41	12	20	80 00	15 00	5 00	12 00	2 00	2 50	45	10 00	1 00	381,690 00
8	Stephens, Gere & Co., Syracuse, N. Y.	37	30	25	40 00	12 50	5 50	6 00	3 25	2 50	90	1 50	10	398 807 50
9	Albert Gleason & Co., Washington, D. C.	39	39	50	15 00	8 50	4 75	5 00	1 50	1 50	78	5 00	‡ 68	409,623 00
10	Henry L. Cranford, Washington, D. C.	36	90	20	30 00	10 00	4 00	5 00	3 00	1 50	78	4 00	1 00	402,240 00
11	John E. Lyons & Co., Baltimore, Md.	34	72	48	32 40	13 20	3 60	2 40	1 20	1 20	1 20	4 80	30	409,974 80
12	Charles Hart, Brooklyn, N. Y.	39	2 50	20	20 00	7 30	5 30	5 50	1 80	2 25	85	6 00	50	521,855 00
13	Beckwith & Quackenbush, Mohawk, N. Y.	40	90	25	40 00	14 00	4 00	6 00	1 00	2 50	2 00	2 00	30	533,500 00
14	J. H. Dewees & Co, Washington, D. C.	33	35	25	20 00	12 00	4 00	10 00	8 00	1 75	70	2 55	.....	.....
15	Hoope's Artificial Stone Company, Baltimore, Md.†	40	20	50	12 00	14 00	12 00	3 00	.....	.....	1 25	.....	20	.....

* Bid does not cover the entire work.
† Bid does not cover the entire work, and is predicated on the use of Hoope's artificial stone.
‡ Two proposals state price 60 cents.

TABLE No. 2. SHAFT, June 30 1884.

Name.	Progress	Earth Excav cu. yds.	Rock Excav. cu. yds.	Size of Shaft.	No. of Holes	Powder lbs.	Days' labor.
West Shaft	97 ft. 1 in.	102	1250	19' × 19'	625	1,095	1,447
Foundry Branch	69 ft. 1 in.	92	243	8' × 14'	181	159	1,270
Rock Creek	58 ft. 6 in.	74	167	8' × 14'	203	175	791
Champlain Ave	137 ft. 3 in.	213	528	8' × 14'	800	595¼	3,289¾
East Shaft	162 ft. 9 in.	1976	162	21' × 21' 19' × 19' 19' diam.	460	357⅝	4,280

TUNNEL.
PROGRESS SINCE JULY, 1884.

Shaft and Heading.	July.	August.	September.	October.	November.	December.	January.
West Shaft	31'	46' 4"	53' 6"	34' 10"	8' 6"	14' 6"	0
Foundry Branch, East Heading	126' 3"	120' 7"	139' 1"	135' 2"	126' 5"	158' 7"	165
" " West "	108' 6"	154' 3"	129' 1"	135' 7"	163' 11"	158' 7"	181
Rock Creek, East "	147'	145' 3"	126' 11"	125' 5"	130' 7"	148'	187
" " West "	155' 2"	163' 1"	163' 7"	138' 5"	169' 4"	177' 4"	209
Champlain Ave. East "	185'	168'	126'	111'	103'	95' 5"	123
" " West "	145'	150'	98'	158'	155'	95' 5"	100
East Shaft	43'	116' 6"	113' 3"	160' 3"	168' 6"	124'	89
Total	940' 11"	1064'	951' 5"	998' 8"	1035' 3"	972' 1"	1054
Total in headings continuously worked and supplied with power drills	866' 11"	1017' 8"	897' 11"	963' 10"	1026' 9"	957' 6"	1054
Daily average progress of above	5.29	5.60	4.97	5.10	5.87	5.26	5.58

Total length of tunnel projected ..... 20715' 8"
Total length of drifts January 31, 1885. ..... 8664'
Total length remaining ..... 12051' 8"

is discharged into two air receivers from whence it leaves by a 12 inch cast-iron main, etc. The air leaves the compressors by a 12-inch cast-iron main, 3,320 feet long, to an equalizing tank, near Rock Creek, 4 feet in diameter and 20 feet long. A 10-inch pipe then leads to the Champlain Avenue Shaft, 5,800 feet distant; a 6-inch pipe leads from Rock Creek to the Foundry Shaft, a distance of 7,375 feet, and another 6-inch pipe from Champlain Avenue to the East Shaft. In the tunnel, 6-inch and 4-inch wrought-iron pipe is used. All the overground pipe is cast-iron, ordinary water pipe, laid along existing streets with leaded and caulked joints. The plant operated by this compressed air is as follows:—Four Lidgerwood hoisting engines, double-geared, reversible link-motion; these engines handle balanced cages; at present, (June 1884), four Knowles pumps, with cylinders 10 by 6 by 12-inches; and 14 Ingersoll "Eclipse" drills, with 3½ inch cylinders and variable stroke. Two drills are used in each heading. The general method of working the rock is to first cut a wedge-shaped mass from the center of the heading by drilling two lines of holes inclined towards each other and towards the axis of the tunnel and then blasting; other holes are then drilled at the sides. All the holes are loaded at one time, the center cut is first exploded, and the side holes immediately afterwards. The explosion of the central holes has no effect on the charges in the side holes. A zigzag method of working by taking out a side wedge, first on one side and then on the other, gave the most rapid progress when the cleavage of the rock ran nearly parallel to the tunnel axis. The explosive adopted is Giant powder No. 2.

From a series of interesting tables prepared by Capt. Symons in his report to Major Lydecker, and from MSS. notes we condense (see Table No. 2) data, to date of June 30, 1884 and Jan. 31, 1885.

The character of the rock is about as follows:—West Shaft, rotten rock; Foundry Branch and Rock Creek, compact gneiss; Champlain Avenue, rock hard, cut seamy. No lining of any description has yet been commenced, as Capt. Symons is convinced that the work of excavation and lining cannot be carried on simultaneously in a tunnel as small as this without materially interfering the one with the other. About 3,000 lin. feet of the tunnel now excavated will require lining, and this work will be commenced shortly at accessible points. The rock varies much in hardness, running from material that can be removed with a pick to that in which a drill can penetrate but one foot in an hour. The greatest difficulty and slowest progress is, unfortunately, found in the longest projected drifts, and, though the contractors have been pushed and hurried in every manner possible, it is probable that the completion of the tunnel will be postponed until the end of 1886, or eighteen months behind the fixed contract time.

We give in Table No. 3 an abstract of proposals received and opened October 5, 1883, for construction of tunnel for increasing the water supply of Washington, D. C.

The Reservoir.—This work is being done

under the charge of John A. Partridge, Asst. Engineer.

The following statement exhibits the amount of work done, and for which estimates and payments have been made up to June 30, 1884:

142,521 cubic yards earth excavation, at 30 cents	$42,756 30
4,644 cubic yards puddling, at 40 cents	1,857 60
1,492 cubic yards concrete, $5.50	8,206 00
66 cubic yards brick masonry, at $9	594 00
428 square yards trap-rock lining at $1	428 00
1,688 square yards paving, at 28 cents	472 64
Total	54,314 54

Ten per cent. is retained according to the terms of the contract.

The above has been accomplished by 15,815 days' work of common laborers, 95 days' work of pavers, 115 days' work of masons, and 7,417 days' work of animals, and the necessary supervision.

Number of loads of earth moved:

By carts	150,349
By wagons	76,728
By wheeled excavators	34,985
By cars	2,140
By horse scrapers	37,654
By wheelbarrows	235,732

Days' service in moving the above:

By carts	2,217
By wagons	975
By wheeled excavators	539
By cars	71
By horse scrapers	288
By wheelbarrows	1,998
By plows	390
By rollers	55

Daily average of loads of each of the above:

By carts	67.77+
By wagons	78.69+
By wheeled excavators	64.90+
By cars	30.14+
By horse scrapers	130.74+
By wheelbarrows	117.97+

Table No. 4 is an abstract of the proposals received and opened on Oct. 5, for the construction of the new reservoir.

The Main Connections. To introduce the water from the new reservoir into the city distribution, a cast-iron main, 75 inches in diameter and 661⅚ feet long, will lead from the affluent gate of the reservoir towards the city. The 75-inch main will terminate in a special casting having three 48-inch branches; one of these 48-inch openings will be used at once, the other two will be closed by caps and held available for future demand. The connection of the new 48-inch main with the present 36-inch main has been accomplished by cutting out a section of the 36-inch main, after the water was turned off, and inserting a special three-way casting; the water was cut off for 45 hours and 50 minutes, while this connection was being made.

The proposals received and opened Sept. 4, 1883 for the cast-iron pipe required were as follows:

PER GROSS TON OF 2,240 POUNDS.

No.	Names and addresses of bidders.	145 tons, 75 inches.	2,383 tons, 48 inches.	41 tons, 12 inches.	59 tons, 8 inches.	6 tons, 6 inches.
1	Walter Wood, Philadelphia	*$50.00	$36.70	$41.75	$42.90	$43.50
2	Andrew H. McNeal, Burlington, N. J.	†75.00	35.20	40 00	41.00	42.00
3	Gloucester Iron Wks. Philadelphia, Pa.	.....	45.00	42.00	43.30	44.80
4	West Point Foundry Ass'n, Cold Springs N. Y.	‡52.50	.....	.....	.....	.....
5	Builders' Iron Foundry, Providence, R. I	§69.00	.....	.....	.....	.....
6	H. H. Ramsey, Baltimore, Md	||44.95	.....	.....	.....	.....

* Coated, but not dipped nor proved.
† Omitting hydraulic test, $55.60.
‡ No bid for special castings.
§ Omitting hydraulic test, $66.
|| Informal; only one proposal received; no bidder's bond.

Contract for 48 inches, 12 inches, 8 inches, and 6 inches, with special castings, awarded to Andrew H. McNeal, dated September 20, 1883.

Contract for 75 inches awarded to West Point Foundry Association, dated September 20, 1883.

ENGINEERING NEWS Three months for One Dollar.

The San Francisco Water Supply.

The San Francisco *Chronicle*, Jan. 24, contains a notice of the work now under construction for doubling the present water supply of that city, or increasing it to 18,000,000 gallons per day.

The Spring Valley Water Works Co., commenced work on its extension in August, 1884. The reservoir now being constructed in the city is 20 miles from Crystal Springs, the source of supply; it is 800 feet by 400 feet, and will have a capacity of 35,000,000 gallons; it will cost about $100,000. The main conduit is a wrought-iron pipe, 44 inches in diameter.

There are 3560 linear feet of brick lined tunnel on the route. The total cost of the improvement is estimated at $1,340,000. Some delay will probably ensue from the rejection by the Water Company of $30,000 worth of iron pipe furnished by the Oliver Bros. of Pittsburg.

As showing the rapid increase in the demand for water, the following figures are given:—In 1870, the number of consumers was 12,640, with an annual consumption of 2,204,165,000 gallons and a revenue of $816,859.10. In 1884, the consumers numbered 2,400 and they used 5,567,534,000 gallons of water, and paid $1,273,472.41. There are now 196 miles of street mains, and 32 miles of 30-in. pipe connecting the reservoirs in San Mateo County with the distributing reservoir in the city.

PERSONAL.

H. C. IVES has been appointed Assistant General Manager of the St. Paul, Minneapolis and Manitoba R. R. with office at St. Paul.

THE UNION BRIDGE COMPANY have removed their offices from 52 Wall St. to 18 Broadway, rooms 713 to 715, where all communications and inquiries in relation to estimates and prices should be addressed.

NEW CIVIL SERVICE EXAMINERS.—The Mayor has appointed the following gentlemen to constitute the Municipal Service Examining Board in place of the members of the old board, resigned: HUGH BONNER, Assistant Chief of the Fire Department; HORACE LOOMIS, an assistant engineer in the Bureau of the Water Purveyor; Police Inspector THOMAS BYRNES, GEORGE N. WILLIAMS, a retired builder; Dr. CHARLES E. SIMMONS, a practicing physician, and JOHN W. BARROW, formerly a Commissioner of Accounts. RUSSELL STURGIS, Secretary and Executive of the Advisory and Examining Boards, has resigned, and CHARLES H. GOODMAN, who was a clerk in the office of Mayor Grace during the Mayor's first term, has been appointed in his stead. Each member of the Examining Board receives $10 for each session of the board he attends. Mr. WOODMAN will receive a salary of $3,500 a year.

CORRESPONDENCE.

OLD STEEL RAILS.—A correspondent asks if there is any uses to which worn out steel rails can be put.

Correction.

48 I ST. WASHINGTON, D. C., Feb. 8, 1885.

EDITOR ENGINEERING NEWS.—In your issue of the 7th inst. under the head of Michigan Engineering Society, you give a paper on the Location of the Canadian Pacific Rocky Mountain Division, F. P. Davis, formerly Resident Engineer. Please correct to *Assistant* Engineer.

Very truly
FRANK P. DAVIS.

"One Yard of Concrete."

SOUTH FRAMINGHAM, Feb. 9, 1885.

EDITOR ENGINEERING NEWS.—In the article in your issue of the 7th inst. on The Caissons, Cribs and Coffer-Dams of the B. and O. Bridge at Havre de Grace, Md., Col. Patton states that the concrete used in the foundations was mixed in the proportion of one part cement, two parts sand, and five parts broken stone; he also states that one cubic yard of broken stone was required to make a cubic yard of concrete. Admitting the above statements to be correct it would be interesting to learn how "*one yard of concrete was made from one barrel of cement.*"

Yours truly,
H. H. CARTER.

Problems in Bridge Construction.

TOLEDO, CINCINNATI AND ST. LOUIS RAILROAD,
TOLEDO, OHIO, Feb. 7, 1885.

EDITOR ENGINEERING NEWS.—The following questions have suggested themselves to me in talking with engineers and bridge superintendents, and a discussion of them may be of interest to your readers.

Does a corbel strengthen the stringer of a wooden trestle enough to warrant the expense of putting it in?

Is a larger stringer necessary when used without a corbel than with?

Would it not be more economical to build a trestle using a packed stringer of a little larger dimensions—if, indeed, larger timber is necessary—instead of using a corbel?

Yours respectfully,
H. A. YOUNG, Chief Engr.

Timber Measurement.

NEW YORK, Feb. 9, 1885.

EDITOR ENGINEERING NEWS.—I would like to get the opinion of bridge experts on the following question: In compensating a contractor for timber construction where a price per foot B. M. for timbers framed in the work has been agreed upon, is it the custom to calculate the exact actual contents of the finished structure, or would the proper basis for payment be to take the dimensions of the smallest sized timber out of which the work could be made, or, to take a practical example, in a cribwork where timbers cross and are halved into each other, should the contractor be paid as though each timber was full-sized, or should the timber cut away at the crossing be deducted?

V.

Special Correspondence Engineering News.

Problems in Water Supply.

PERU, INDIANA, Feb 3, 1885.

EDITOR ENGINEERING NEWS:—We want a book on hydraulics, or containing information like the following: With a reservoir pressure of say, 90 pounds, a supply pipe of 2½ inches diameter and a jet of ½ inch how much water will be used per hour? Also what amount of power will be lost per each square angle made by a supply pipe? Also when water is used to run machinery, what loss in power will be caused by a water meter. These are some questions coming up here in connection with the City Water-works, and the action of the trustees thereof, and we wish to get a book in which the desired information can be found.

Yours truly,
FULWILER & COLE.

53 OPERA BLOCK, MANCHESTER, N. H., Feb. 6, 1885.

EDITOR ENGINEERING NEWS:—I have yours of the 3rd relating to hydraulic questions in Peru, Ind. Chapter XII. of Water Supply Engineering, gives most of the information desired and especially formula 1, page 215 where, $N = .815\ S \times \sqrt{2\ g\ H}$. Since one foot head is equivalent to .434 lbs. per square inch pressure, 90 lbs. = $\frac{90}{.434}$ = 207.37 feet = H; velocity of issue = $\sqrt{2\ g\ H}$ = 115.56 feet per second (table 40 page 193). Area of ½ inch aperture $S = .7854d^2 = .001363$ square feet. Coefficient o short tube .815 approximately. Volume Q = velocity × section × coef. = 56 feet × .001363 square feet × .815 = .12836 cubic feet per second, or 7.7016 cubic feet per minute. This will be reduced by friction in the service pipe moderately only, if a 2½ inch service is used from main to motor *vide* equation 27 page 269.

The formula for effect of bends is given on page 273 A meter should not consume more than 3 feet head when running rapidly.

Yours very respectfully,
J. T. FANNING.

LITERATURE.

Steam Making; or Boiler Practice. By CHARLES A. SMITH, C. E., Professor of Civil and Mechanical Engineering at Washington University, St. Louis, Mo.; M. Am. Soc. C. E., the Engineer's Club of St. Louis, etc. Chicago, 1884. The *American Engineer*, Publisher.

The contents of the above work are re-printed from the *American Engineer*, of Chicago. The author claims little originality in his production, but has earnestly endeavored to present his examples, as much as possible, from the best American practice. The plan of the treatise includes the nature of heat and the properties of steam; combustion; externally and internally fired boilers, and the design and construction of boilers. The late Professor Smith was a hard student and a hard worker, and his "Steam Making," bears evidence of the patient toil and careful study involved in the proper presentation of his subject. It occupies a middle ground between works too expensive for general use and others devoted to special local practice, and must therefore prove a welcome addition to the library of the steam engineer. The book is handsomely illustrated and unexceptionable in its press-work.

Trautwine's Civil Engineer's Pocket Book.

This is the most notable book in the literature of Civil Engineering published in the world—a broad statement, and yet if not correct, we beg to be corrected. It is the fruits of a long life of active, intelligent, searching investigation, and subsequent adaptation for practical use. It is a library in itself, which, if every copy now in existence were destroyed, would cause the civil engineering profession untold inconvenience, besides considerable cost, to obtain the information which is contained in its closely printed pages. The late Mr. Trautwine spared no personal labor in correcting and perfecting his wonderful book, up to a period shortly before his death; since then the property in its entirety, through the failure of a Philadelphia publishing house which held the control of it, has passed by purchase into the possession of Mr. Jno. C. Trautwine, Jr., who, since July last has been hard at work remodelling, simplifying, modernizing, and reprinting the entire work. The edition is now being printed as rapidly as possible, and is promised for sale by the middle of the coming month. A large number of orders for the new book are now waiting to be filled and the list is increasing. We reprint for the general benefit, the Preface to the Twenty Second Thousand of this remarkable book, so that intending purchasers may get a fair idea of what changes have been made by Mr. Trautwine, Jr:

PREFACE TO THE TWENTY SECOND THOUSAND.

Since the appearance of its last edition (the twentieth thousand) in 1883, the "Pocket Book" has been thoroughly revised, and many important additions and other alterations have been made. These necessitated considerable change in the places of the former matter, and it was deemed best to turn this necessity to advantage, and to make a thorough re-arrangement, putting all of the articles, as far as possible, in a rational order, so that the reader might, in many cases, be able to readily find a desired subject without the use of the index, which, notwithstanding, has been greatly enlarged. All of the articles formerly in the appendix, and such of those in the glossary as seemed out of place there, have been transferred to their proper places in the body of the work.

In making the re-arrangement, the rule has been to proceed from the abstract to the concrete, from the theoretical to the practical, from the general to the particular. All this will appear from a glance at the new and very full table of contents on pages xvii to xxvi. Thus, beginning with Arithmetic, we proceed to Mensuration of lines, angles, surfaces, solids, the simple, in each case, preceding the complex. Next come the various branches of Surveying, with surveying and engineering instruments. Then Sound, Heat, Air and Water, Hydrostatics, Hydraulics, Water Supply, and Mechanics. Next, under Materials and their Properties, we have Specific Gravity, Weight, Weights and Measures, Weights, Dimensions, Prices, etc., of many manufactured and other articles, and Strength of Materials. This last leads naturally to strengths of beams and trusses, after which follow Suspension Bridges. Proceeding next to subjects more closely connected with actual construction, and in which theory plays a less important part, we come to Well Boring, Dredging, Foundations, and Stonework, the latter including Quarrying and Masonry, Bricks, Mortar, Cements and Concretes, Retaining Walls, and Arches of brick and stone. Then follows the article on Railroads, under which head have been grouped, in order, Railroad Construction (including Grades, Curves, Earthwork, Tunnels, Trestles, Roadway, and Turnouts,) Railroad Equipment (including Turntables, Water Stations, etc.) Railroad Rolling-Stock and Operation, and Railroad Statistics. By the transfer of the various articles in the appendix to the body of the book, the glossary comes to its proper place at the end of the volume, just before the index.

It is believed that this thorough re-arrangement will in many cases, enable the reader to find a subject more readily by the aid of the table of contents than by that of the index; or, indeed, as already suggested, without the aid of either, and by the natural place of the subject in the order of arrangement.

The following are some of the principal changes of subject matter in this edition. (The former pages of revised articles are given in parentheses.) On page 34, a table of Fractions reduced to exact decimals has been added. On pages 128 to 140, are two new Tables of Circumferences and Areas of Circles, to not less than four places of decimals. These tables have been calculated independently by two persons, expressly for this work, and the two results compared after the casting of the plates. They are therefore believed to be correct. The rules for finding chords, radii, etc., of Circular Arcs, p. 141 (16, 17) have been greatly extended, re-modeled, re-illustrated, and systematized. Under Thermometers, pp 213, etc. (309, etc.), the rules for conversion of Fahrenheit to Centigrade readings, and *vice versa*, have been put into more convenient shape, and others added for the conversion of both of these scales to that of Réaumur and *vice versa*. In consonance with this change, and to make this subject complete, three new Conversion Tables have been substituted for the one formerly given. The article on Flotation, etc, p. 235 (635) has been corrected and amplified. The opening articles in Hydraulics, pp. 237, etc., (535, etc), in which are explained the divisions of the total head and their several offices, have been re-written, and it is believed they will be found to give a fuller and more satisfactory explanation than before, of the various phenomena connected with this subject. On p. 254 will be found a new formula for the discharge through a pipe of varying diameter. The remarks on City Water-Pipes, Valves and Fire-Hydrants, pp. 293 to 305 (572, 577) have been re-written, enlarged, and modernized. New forms of Pipe-Joint, Stop-Valve, and Fire-Hydrant, and several modern appliances, are described and illustrated; and recent data are given for the Cost of Pipe and Laying. On p. 364 (587) the Velocities, etc., of Falling Bodies are tabulated in convenient form. The remarks on Centrifugal Force, p. 366 (494), have been revised, and the explanation made clearer. On p. 396 will be found a concise but full account of the arrangement of the new Standard Railway Time. The various articles on pp. 398 to 433 (337 to 382) in which are given the Dimensions, Weights, Prices, etc., of various manufactured articles in common use have been thoroughly overhauled and corrected up to the present time. Among these may be noted especially Iron pipes, p 405 (364) to which Boiler Tubes have been added; Bolts, Nuts, and Washers, pp 406 to 408 (374 to 376); a new list of Wire Gauges, giving the new British Standard Gauge, p 416 (368); Wire Ropes, p. 413 (380); Tin plates, p. 419 (379), and Window-Glass, p 432 (514).

On p 449 (234) is a revised and complete list of Phœnix Segment Columns, illustrated. A number of changes have been made in Rivets and Riveting, pp. 468, etc. (653, etc).

Under Transverse Strength, pp 478, etc. (183, etc.), have been grouped the several articles on Moments of Rupture, of Inertia, and of Resistance, Open and Closed Beams, Shearing of Beams, etc., which were formerly scattered through widely separated parts of the book (183, etc., 194, etc. 217, etc., 642 to 650). These have been carefully revised and amended, and arranged into a systematic whole, from which the student can now obtain a clear and correct notion of this somewhat troublesome subject. On pp 521 to 523 (211 to 213) are new rules and tables for I and channel beams; and, on pp 525 to 527 (373) similar rules and tables for angle and T iron. These have been carefully compiled from the latest tables of the Pencoyd Works, which were selected on account of the large range of sizes made by those works, and the completeness of the data obtainable in regard to them. On p 524 (304) are illustrations of recent bridges of I beams in use on the Penna. R.R. The article on Shearing of (or vertical strains in) Beams, p 532 (642), is entirely re-written and re-illustrated. A new article on Riveted Girders is given, pp 537 to 546 (214 to 217), in which much fuller rules, used in the best practice of to-day, are substituted for those of Fairbairn; and illustrations from the present standards of the Penna. R.R. are given in place of those from the Charing Cross Railway of a quarter of a century ago.

The treatment of the Fink Roof Truss, pp 574, etc., (261 etc.), and that of the Braced Arch, p 592 (274), have been corrected and simplified. Increased dimensions have been given in the tables of Wooden Howe and Pratt Trusses, pp 595 and 596 (284 and 285), to provide for the modern weights of such loads as would probably be placed upon such structures.

Considerable changes are made in Suspension Bridges pp 615 to 625 (588 to 597). The formulæ for the strains in the main chains have been re-arranged, and those for the strains in the back-stays and on the piers have been much extended and illustrated, and made to cover the ground more fully. The description of the Pierce Well-borer, p 626 (636), has been corrected, other boring tools described and illustrated, and a new article on Artesian Well-Drilling added. The Nasmyth Steam-Hammer Pile-Driver is described on p 642. The articles on Stonework, pp 651 to 668 (310 to 313) have been greatly enlarged by the addition of new articles on Machine Rock-Drills, Air Compressors, and Modern Explosives. In the first named, sectional views and descriptions of several of the more prominent modern drills are given.

Under Railroads, pp 722 to 818 (409 to 428, etc.), will be found collected most, or all, of the former matter of the book, relating exclusively to that subject, and much that is new. A Table of Curves, with Radii, etc., in *meters*, has been added, on p 728, for the convenience of those who have occasion to work by the metric system. Under Earth-work, pp 747, etc. (418 to 428, 435 to 441), original rules and tables have been added for estimating the cost of moving earth by means of the modern wheeled and drag scrapers, and that of moving earth and rock by cars and locomotives. In this connection, also, the operation of the modern steam excavators, or land dredges, is described, and data given concerning their capacity and their cost of operation.

The article on trestles, p 755, etc. (307, etc.), is greatly enlarged by descriptions of the new Portage, Kinzua, and other recent *iron* trestles. The former articles (390 to 408) on Rail-joints and Turnouts have been replaced by new, enlarged, and re-illustrated articles, pp 763 to 789, based upon present practice. Under Rail-joints the principal place has been given to the fish and angle plates now so generally used, after which follow the modern Fisher and Gibbon joints. The older forms, including most of those illustrated in former editions, are briefly referred to for purposes of comparison. Under Turnouts, the lengthy details of the stub-switch stand, etc., are omitted, and the point and Wharton switches are given greater prominence. Several important improvements having been made in the Wharton since our last edition (in which a new description of that switch was given), a further revision became necessary, and the new article is accompanied by a new cut, showing the switch in its latest form. Under Frogs, prominence is given to the Steel-Rail Frog, which has now supplanted the older forms on first-class lines; the Mansfield Elastic Frog is described and illustrated; and an explanation of the working of the Spring-Rail Frog is added, with original cuts. The directions for laying out turnouts from curves have been simplified.

Under Turntables, the description of the Sellers table has been rewritten and brought into line with recent improvements; and several modern forms of plate and cast-iron turntables are described and illustrated. The remarks on Track-Tanks, p 802 (434), have been extended, and a cut added, showing a cross-section of the Penna. R. R. standard tank.

The scattered data (411 to 413) on Locomotives and Cars, and the Railroad Statistics formerly given (409 410) have made room for tabulated modern data, pp 805 to 818, on these subjects, much fuller than those which they have replaced, and covering both standard and narrow-guage roads.

The following are among the more important of the minor changes.

New page	Compare with	Old page
55 Exterior Angles		62
56 Definition of Complement and Supplement		62
110 Table of Polygons		15
112 Trigonometry. Case 2		39
146 to 148 Circular Segments		22, 24, 25
149 etc. Ellipse		25, 26, 630
159 Cylindric Ungulas		31, 32, 636
220 Records of Rain-falls		518
232 Rankine's Formula for Thickness of wall at Base		531
245 Remarks Introductory to Table 2		541
248 Art 3		542
293 Weights of Cast-Iron Pipes		364
332 Polygon of Forces		470
348 Center of Gravity (foot)		442
380 Specific Gravity. Introduction		383
381 etc. Heading of Table		384 etc.
384 Foot-note		
425 Creosote, etc.		359 to 362
433 Paper		151, 152
436 Crushing Loads of Masonry and of Ice (foot-notes		175
438, 439 Iron Pillars		222, 223, 234
504 to 506 Deflections, etc., of Beams		196 to 198
572 First Paragraph		262
573 Foot-Note		264
710 Brick Arches, Penna. R. R. Phila.		
803 Track Scales		409

A number of minor additions have been made to the glossary.

Most of the new matter is in nonpareil, the *larger* of the two types heretofore used. Boldfaced type has been freely used; but only for the purpose of guiding the reader rapidly to a desired division of a subject. For *emphasis*, *italics* have been employed.

Illustrations which were lacking in clearness or neatness have been re-touched and re-lettered, or replaced with new and better cuts. The new matter is very freely illustrated.

New rules have been put in the shape of formulæ, and many of the old rules have been re-cast into the same form. In doing this, the terms of the formulæ have, except where this would be exceedingly cumbersome, been written on it in full, as in former editions, so that the reader is not compelled to look back over a number of pages to find the meaning of arbitrary symbols, and tax his mind with remembering them when found. It is believed that the formulæ will be found at least as easy to use as the rules. Take, for example, the second formula in Art 10, p. 262 (556). In its former shape it read:

"To find the time reqd to fill the reservoir, *m*, from any level, *c*, above the top of the opening, to any upper level, *d*." (This should have read "to the level *a* of the upper reservoir.")

"RULE. First find the area in sq ft, of a hor section of the reservoir *m*, which is supposed to be of uniform section throughout its depth. Mult together this area, the constant number 2, and the sq rt of the vert height, *a*, *c*, in ft. Call the prod *p*. Mult together the area of the opening *o*, in sq ft; the coeff of contraction (usually about .62, whether the disch be into the air or under water); and the constant 8.02. Call the prod *y*. Div *p* by *y*. The quot will be the reqd time in secs.

It is safe to say that any one, capable of using the above rule, can as readily use the following formula, in which it now appears

$$\text{Seconds required to } \textit{raise level} \text{ in } m \text{ from } c \text{ to } a = \frac{\sqrt{\text{height } a\,c \text{ in ft}} \times \text{hor area of } m \text{ in sq ft} \times 2}{\text{area of opening } o \text{ in sq ft} \times .62 \times 8.03}$$

and, moreover, the formula has the great advantages of showing the whole operation at a glance, of making its

principle more apparent, and of being much more convenient for reference. The formula might have been slightly condensed by giving the *product* of .62×8.03, instead of the *factors*; but it was preferred to give the latter because they show the principle of the formula. The article referred to has also been otherwise improved.

The addition of new matter, and a number of blank spaces necessarily left in making the re-arrangement, have increased the number of pages about one-fifth.

The new index is in stricter alphabetical order than that of former editions, and contains more than twice as many entries, although much repetition has been avoided by the free use of cross-references, without which this part of the work might have been indefinitely extended.

The selection of articles of manufacture or merchandise for illustration, has been guided by no other consideration than their fitness for the purpose, and the courtesy of the parties representing them, in supplying information.

The writer gratefully acknowledges the kindness of those who have assisted in furnishing and arranging data.

J. C. T., JR.

PHILADELPHIA, January, 1885.

A letter to the Chief of the Bureau of Statistics of the U. S. being a Fagot of Yankee Sticks, tough, if not telling; consisting of Quotations, Opinions, Free-trade fancies Protection blessings, Political economy, Democracy, Commercial tricks, England's power, Yankee ability Locomotives, Iron bridges, Interoceanic canals, etc., etc., Intended as a Salmagundi, with sauce that may not suit every taste, by W. W. EVANS, "*Quid Ridides.*" 1885.

The above title smacks of Puritan days in the recitation of matter included within its covers. But the general purpose seems to be to laud American Engineering ideas and practice, and illustrate by the wide experience gained in the professional life of the author in North and South America and across the ocean.

TRACK.*

BY W. B. PARSONS, JR., C. E.
ROADMASTER SUSQUEHANNA DIVISION ERIE R. R.

(*Continued from page 92.*)

Frogs and Switches.—Fig. 57, shows the arrangement of one track passing out from another and is known as a Turnout. Its essential parts with their respective names are given. The device for letting the flanges of the wheel on one track cross the intersecting rail of the other is termed a Frog, so named from its resemblance to the "frog" in a horse's hoof. The simplest method of passing from the main track to the Turnout and the one most decidedly in general use, is to have a pair of rails connected together so arranged that while one end is a fixture in the main track, the other can be moved so as to be a part of either main track or turnout. This is called the stub switch. That end of these rails which is fixed is called the "heel" and originally they were hinged here by means of chains or fish plates, so that when the loose end called the "toe" was turned for the turnout, the rails were straight and formed an angle at the heel. These rails are variously known as "switch," "swing," or "moving rails" and

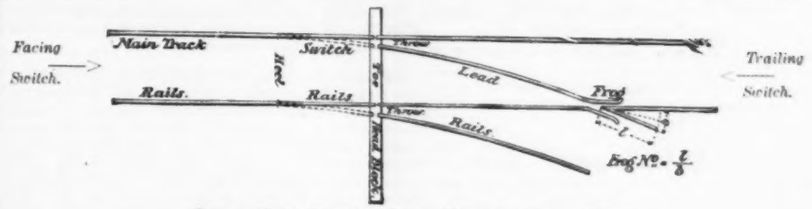


FIG. 57.—FROG DIAGRAM—GIVING NOMENCLATURE OF PARTS.

are held together by "switch-rods." The toe rests on a large piece of timber, called the "head-block" on which are placed the "head chairs" and "switch stand." The rails between the head-block and the frog, which belong entirely to the turnout, are called "lead-rails." When the switch turns out on the right side it is called a "right hand" turnout, and so on the other side a "left hand" turnout; right and left being with reference to one facing the switch, Fig. 57, which illustrates a right hand switch, shows also a single turnout or a "single-throw" switch, but when there is a right and left combined, that is, a switch in both directions at the same point it is called a double turnout or a "three-throw" switch. A "crossover" consists of a single turnout, in each of two parallel tracks, with a connecting piece of track between them, so that trains can pass from one of the parallels to the other. In this case it is evident that the turnouts are both "left" or both "right" as the case may be. A "facing" switch is one where a train running on the main track passes from the head block to the frog while a "trailing" switch points in the opposite direction. This is explained by the arrows in Fig. 57.

Such is an outline of the various parts which we will now consider in detail. The line or curve given to the lead-rails should be circular and scientifically considered as joining two tangents, one of which is the side of the frog, and the other the opposite main track rail. Let it be carefully understood that the term main track is used here merely to distinguish that track from the turnout. Now, since the line of the lead-rail is a regular curve joining two tangents the switch-rails when thrown

These are all the dimensions required to lay out a turnout, those needed in actual field use are printed in heavy face type. They are practically true whether the turnout is from a straight line or from the inside or outside of a curve, the only variation being in the degree of curvature, which is approximately increased or decreased by the degree of main track curve according as it springs from the inside or outside respectively. Inasmuch as the curves for ordinary frog numbers are sharp, it should be avoided as much as possible to have the siding come from the inside of a curve.

(TO BE CONTINUED.)

TABLE No. 1.—Dimensions of Single and Double Turnouts.

Frog Number	Frog Angle	Head Block to Frog Point	Length of Moving Rail	Total Lead Heel to Frog Point	Tangent	Radius of Turnout Curve	Degree of Curvature	Head Block to Crotch Frog	Angle of Crotch Frog	Number of Crotch Frog
		FT. IN.	FT. IN.	FT. IN.	FT.	FT.		FT. IN.		
	11° 25′ 16″	33 1	14 0	47 1	23.78	235.42	24° 31′	19 4 1-2	16° 08′ 19″	3.527
5 1-2	10° 23′ 20″	36 4 1-2	15 5	51 9 1-2	26.11	285.85	20° 13′	21 3 1-2	14° 40′ 56″	3.881
	9° 31′ 38″	39 1 1-4	16 9 3-4	56 6	28.45	330.60	16° 58′	23 2 1-2	13° 27′ 57″	4.235
6 1-2	8° 47′ 51″	43 0	18 2 1-2	61 2 1-2	30.79	397.85	14° 26′	25 1 1-2	12° 26′ 07″	4.589
	8° 10′ 16″	46 3 3-4	19 7 1-4	65 11	33.13	461.42	12° 27′	27 0 3-4	11° 33′ 04″	4.943
7 1-2	7° 37′ 41″	49 7 1-2	21 0	70 7 1-2	35.47	529.69	10° 50′	28 11 3-4	10° 47′ 02″	5.297
	7° 09′ 10″	52 11	22 5	75 4	37.81	602.67	9° 31′	30 11	10° 06′ 43″	5.651
8 1-2	6° 43′ 59″	56 2 3-4	23 9 3-4	80 0 1-2	40.16	680.35	8° 26′	32 10	9° 31′ 09″	6.005
9	6° 21′ 35″	59 6 1-2	25 2 1-2	84 9	42.51	762.75	7° 31′	34 9 1-4	8° 59′ 30″	6.359
9 1-2	6° 01′ 32″	62 10 1-4	26 7 1-4	89 5 1-2	44.85	849.85	6° 45′	36 8 1-4	8° 31′ 10″	6.713
10	5° 43′ 29″	66 2	28 0	94 2	47.20	941.67	6° 05′	38 7 1-2	8° 05′ 40″	7.067
10 1-2	5° 27′ 09″	69 5 1-2	29 5	98 10 1-2	49.55	1038.19	5° 31′	40 6 1-2	7° 42′ 36″	7.420
11	5° 12′ 18″	72 9 1-4	30 9 3-4	103 7	51.90	1139.42	5° 02′	42 5 3-4	7° 21′ 35″	7.774
11 1-2	4° 58′ 45″	76 1	32 2 1-2	108 3 1-2	54.25	1245.35	4° 36′	44 4 3-4	7° 02′ 26″	8.128
12	4° 46′ 19″	79 4 1-2	33 7 1-2	113 0	56.60	1356.00	4° 14′	46 3 3-4	6° 44′ 51″	8.482
12 1-2	4° 34′ 52″	82 8 1-4	35 0 1-4	117 8 1-2	58.95	1471.35	3° 54	48 3	6° 28′ 40″	8.835
13	4° 24′ 19″	86 0	36 5	122 5	61.30	1591.42	3° 36′	50 2	6° 13′ 43″	9.189

*For methods and formulæ for calculating turnouts etc., see "Turnouts" published in ENGINEERING NEWS of last year, and now issued in book form and on sale at this office.

*Copyright by ENGINEERING NEWS PUBLISHING Co. All Rights Reserved. This article was commenced on October 4 1884.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E. : M. INST. C. E

Continued from page 92.

DCCXXI. GLADBROOK, IOWA.

Gladbrook, Tama, Co., Iowa, in lat. 42° 10′ N., long. 92° 30′ W. is on Wolf Creek. It was incorporated a town in 1880. Water-works were built in 1883 by the town, taking the supply from the creek. The water is conveyed by 50 feet of 4 inch drain pipe, to a pump well, 4 feet in diameter, and 20 feet deep, and is thence pumped by a double acting force-pump, operated by a wind mill to a wooden tank 16 feet high and 18 feet in diameter, holding 30,000 gallons and being 100 feet above the pump.

Distribution is by ½ a mile of 6 inch Wyckoff wood pipe with 3 fire hydrants.

The works are for fire purposes only, and have cost $2,800 which is the amount of the bonded debt at 5 per cent.

The cost of maintenance, is about $10 annually. The population in 1880 was 800.

T. E. Mann, is Mayor.

DCCXXII. GLENWOOD, MINN.

Glenwood, Pope Co., Minnesota, in lat. 45° 40′ N., long. 95° 30′ W. is in a wooded glen, 100 feet below the level prairie overlooking Lake Whipple.

Water-works were built by the village in 1883, taking the supply from Spring Creek, across which a dam was built of wooden cribs filled with stone, planked on the upper side and banked up with earth, forming a reservoir holding 150,000 gallons. Thence the water is conveyed by wrought-iron pipe to the village, and distributed by 1.4 miles of wrought-iron pipe, with 4 fire hydrants and 6 taps. Service pipes are of galvanized iron. The works have cost $6,000. The bonded debt is $4,000 at 10 per cent. The yearly expenses of maintenance are $200, and the receipts $100 The population in 1880 was 464. K. J. Kinney is Superintendent.

WATER.

FERGUS FALLS, Minn., is discussing sewerage.

THE Vicksburg, Miss., water-works may be regarded as an assured fact.

WATER COMMISSIONERS.—The new commissioners for Fonda, N. Y. are A. B. Gillis, Wm. H. Wilson and Geo. Jones.

INDICATIONS are that the Knoxville Gas Company are on the anxious seat as to the new gas company that is to be started in that city.—*Chattanooga Times.*

ELLSWORTH, ME., is to be furnished with water for domestic, industrial, and manufacturing purposes by the Ellsworth Water Co., now applying for incorporation.

CEDAR RAPIDS, IOWA, will expend $2,000 in preliminary surveys for the construction of a sewerage system.

THE presence of surface water from the streets is shown in St. Louis, by the salt taste given the water of wells along the lines of horse car tracks, the car companies using large quantities of salt to melt the snow in winter time.

SEWERAGE and water supply in St. Paul, Minn., will call for an early expenditure of nearly $1,000,000 according to the opinions of Minnesota legislators, expressed at a meeting held on the 2nd at St. Paul.

R. D. WOOD & Co., have the contracts for furnishing the iron pipe to be laid in Willimantic, Conn. The Willimantic Co., will call, this month, for bids for the construction of the reservoir.

THE Water Commissioner of St. Louis has presented a petition for water facilities, which will require 1,200 tons of pipe, 60 special castings, 100 fire plugs, and 75 stop-cocks, estimated to cost $40,000. He recommends immediate purchase. The matter was referred to President Flad.

THE Buffalo Water-Works claim to be self-sustaining, although in 1883 the price of water to the ordinary consumer was reduced 33⅓ per cent., and the price of water measured by meter was reduced from 9 to 3 cents per 1,000 gallons.

THE Committee on Water Supply will give a hearing to parties interested in the petition of J. E. Everett and others, that authority be granted the town of Norwood, Mass., to take certain lands and streams for a water supply and to issue bonds to pay for the same, at Room No. 14, State House, Boston, on Friday, Feburary 20, at 10 o'clock a. m.

THE ordinance giving authority to the Water-works Board to issue bonds to the amount of $300,000 for the purpose of carrying on the improvements on Woodland Hills, Cleveland, O., was passed. Thus far, including the amount above mentioned, there will have been issued of the $1,200,000 originally authorized, $800,000.

OUR Houlton, Me., correspondent writes: The recent fire in our village and subsequent increase of insurance policies to six per cent., has induced our citizens to build with brick the coming season. It has also stimulated the people to organize a water company, and immediate contracts for the construction of water-works will be awarded.—Bangor *Commercial*.

WAY CROSS correspondence Savannah, Ga., *News*, Feb. 3. After much unavoidable delay, set-backs and discouragements, the artesian well here is now fairly begun. The Superintendent, Mr. Hefright, commenced driving the piping yesterday afternoon, and by dark this evening, if the work continues uninterruptedly, over one hundred feet will be reached. The opinion of the knowing (?) ones is that a good flow of water will be obtained somewhere about five hundred feet below the surface. A good artesian well here will no doubt contribute materially to the health of the place and enhance the value of property.

A BILL was introduced into the Maine Legislature January 29th, for a water supply for the city of Bath; and another bill to incorporate the Augusta and Hallowell Water Company, naming as incorporators, J. Manchester Haynes, P. O. Vickery, E. C. Allen, H. M. Heath, H. S. Osgood, Ira H. Randall, George E. Weeks and J. R. Bodwell. The corporation to be allowed to issue bonds for construction of works not exceeding $400,000. Capital stock $100,000 to be increased to $400,000 by vote of the corporation. Water to be taken from the Kennebec river.

EAU CLAIRE, Wis., is in labor on the question of water works. The following named firms have put in bids to be considered by the common council: Beach Co., Minneapolis, 200 hydrants at $60 each; Fairbanks, Morse & Co., Chicago, 200 hydrants at $57; Phelps & Co., Minneapolis, 200 hydrants at $60; Hinds, Moffet & Co., Watertown, N. Y. 200 hydrants at $62; Knowlton & Co., Minneapolis, 200 hydrants at $52.46; Messrs. Flagler & Miller (Lockport and Louisville,) 200 hydrants at $65; each of the foregoing bids require $50 for the additional hydrants; John S. Owen, H. M. Stocking and H. C. Putman, Eau Claire, 300 hydrants at $45; additional hydrants at $35.

A THREE MILE PIPE CONTRACT.—Mr. Sleno, representing the Michigan Pipe company of this city, has returned from Au Sable, where he has secured an important contract for furnishing three miles of 4 to 10 inch piping for the water-works of that progressive village. The contract includes 41 fire hydrants, and connections complete, ready for pressure from the pumping station. The line must be ready by July 1. Mack Walker, of Port Huron, will furnish the machinery.

The Michigan Pipe company is also furnishing North Muskegon, Newaygo and Lakeside, Michigan, with piping. The works at these places are approaching completion and will be given a test in the spring. The Wyckoff patent continues to be the favorite piping securing contracts in direct competition with iron material, owing to its superiority in every respect.—Bay City *Tribune*, 5th.

THE contract for making new valve chambers for engine No. 4, at Brilliant station Pittsburg, was awarded to the Atlas Works at $8782.60.

RICHMOND, Ind., Feb. 7.—John M. Westcott, President and almost sole proprietor of the Hoosier Drill Works, has been hostile to the water-works company from the start, and now signifies to the mayor his willingness to make a proposition to the council that promises most favorably for the city, and disastrously for the company. Council long ago rescinded the bill granting the company a franchise on the ground that the company had not complied with its agreement. The company brought suit to compel the city to perform specific duty under the contract, and Judge Frazier ruled that none existed. The company then began making overtures for terms, which council is on the eve of joining them in, but Westcott's move must bring matters to a halt. He says he will duplicate the company's proposed works, which are, in the meanwhile, half built, and obligate himself to sell them to the city after ten years for $150,000, which is about half what the company say theirs will cost; and he also proposes to operate them during these ten years and save the city from $1,500 to $2,000 a year in water rental by supplying fire plugs for $10 less than the present company does.—Indianapolis *Journal*.

A LECTURE which was given by Sir Frederick Bramwell, at the Institution of Civil Engineers, contains figures that show the difficulties which attend the discovery of a new water supply for the metropolis. It has been found that, out of a total annual rainfall of 27.843 inches, 6.519 inches passes through three feet of soil and 10.590 inches through the same depth of chalk. The proportion of the percolation to the rainfall varies greatly from time to time, even for the same seasons. Every gallon of water pumped and carried away from an absorbent district is so much abstracted from the flow of the streams of that district. In inland districts the streams form an exact gauge of the excess of the rainfall over the water carried off by evaporation, and any artificial diminution of the water must affect the streams. An annual supply of 4 inches of rain, from every square mile of country, gives a daily quantity of nearly 160,000 gallons of water, which, at 32 gallons per head per diem, will suffice for a population of 5,000 souls. A population of 4,000,000, like London, will therefore, if supplied from deep wells in the chalk, absorb the total water supply of 800 square miles of country, or of an area one-quarter larger than the county of Hertford, and the whole of the surface streams over this large area will disappear in dry years.—London *Architect*.

TOWNS COMBINING TO OBTAIN WATER.—SOUTH ABINGTON, MASS., February 6.—For some time committees on the water supply for different towns in this section have been discussing the feasibility of supplying the towns of Abington, South Abington and Rockland with water, and a petition has been presented to the Legislature by J. F. Cox. It represents that the towns are without an adequate supply of water for protection, and that a suitable supply can be obtained from Big Sandy Bottom pond, Pembroke. And it is further asked that a corporation may be formed. It has been proposed to build a pumping station at Pembroke, and lay a main pipe for a distance of five miles to Beach hill, in Rockland, where they will build a stand pipe 100 feet high and 25 feet in diameter. The cost has been estimated as follows: Station, $20,000; main pipe, $60,000; the stand pipe, $20,000; making a total of $100,000. The plan has been discussed in all its bearings by the committees from the interested towns, and a regular plan for laying the pipes adopted. A public hearing will be given in the State House, February 24.

THE ATLANTA, GA., WATER SUPPLY.—At a special session of the Council of the city of Atlanta, held on the 3rd inst., the subject of an improved water supply was made the question of the evening. On invitation, Water Commissioner Adair addressed the Council on the subject under discussion. He said that the Commissioners were all of the opinion "that we must increase our facilities and capacity for delivering the water from the works into the city. The city has now reached that point in its history when the means of supplying the water is wholly inadequate to the demand. In other words, the city has out-grown the water-works. There is no lack for water, but there is no way to get it into the city. Ten years ago, when the water-works were put up, they fitted the city. The city has grown but the water-works have not. Then the water was used but little, now it is used for sewer flushing, by manufactories, hotels, railroads, business houses, the carshed, and nearly everything else. Two years ago we came before this council and asked for a 20-inch main from the water-works to Richardson street and two engines. We got the engines but we still want that main.

Colonel Adair then recounted the great trouble to be apprehended from the machinery breaking down or giving way, and said that the commission had done all in its power to improve the system. He then referred to the meter system, which had been adopted last year, and showed that a great deal of water had been saved, and declared that saving the water benefitted the machinery to the extent of the power saved. He stated that about 600 meters were now in use in the city. Speaking of the inadequacy of the means to transmit the water into the city, Colonel Adair said:

The water-works began supplying the city with water on October 1, 1875. The capacity of the works, as originally constructed, was two million gallons in twenty-four hours. The original length of the mains in the city, including the main pipe from the works, was eight miles. That main from the works was a sixteen inch main. The present capacity is six million gallons in twenty-four hours, to be forced through a main pipe that was put in to deliver the two million gallons as intended in the original construction of the works. This is the total pumping capacity—all the machinery being in order. The present length of the mains is now twenty-one miles. There are to be supplied 1,800 of the three-quarter inch taps, thirty-eight hydraulic elevators each having a three inch pipe from the main beside all the railroads, hotels and passenger depot; also most all the manufacturing establishments, stables, stock-yards, ice factory and public schools. It is almost accomplishing an impossibility to force six million gallons through the main that was constructed for two million gallons. Now it will cost about $150,000 to give us the improvement needed. First we want a new twenty-four inch main from the pumping station to the city. This will cost $100,000. Then we want a ten million gallon pump which would cost probably $50,000. The new main would be of course but a step in the right direction, and additional pumping machinery must be put in to supply the rapidly increasing demand; this must be done by taking out the small or two million pump and putting in its place a new ten million pump, which will make the total pumping capacity sixteen million gallons. The supply—the capacity of the reservoir has never been very heavily taxed, the lowest stage that was ever reached being the summer of 1883 when the water went down about four and a half feet, during last summer in the long drouth, it fell about three feet.

Mr. Stockdell advocated the construction of reservoirs at high points in or near the city and the flow of water from them.

Colonel Hoge arose and said that he was present as the representative of a syndicate who wanted to buy the water-works. He said his syndicate was reliable and would pay cash for the works. He was not at liberty to say more publicly but would confer with the proper parties.

Colonel Adair said the commission would be glad to meet Colonel Hoge's syndicate.

Mr. Stockdell offered a resolution directing the mayor, the water committee, and the water commission to confer with Colonel Hoge. It prevailed.

NEWS OF THE WEEK.

Contracting.

Abstract of Proposals for finishing Lock No. 2 Kanawha River, opened Feb. 3rd by Lt. Col Wm. P. Craighill, U. S. Engineer, Baltimore: No. 1, Harold & McDonald, Pittsburgh, Pa., $91,543; No. 2, Hoag, Petitdidier & LeDuke, Pittsburgh, Pa. $72,049; No. 3, Buffner & Grady, Charleston, W. Va., $78,206.50; No. 4, Frank Hefright, Coal Valley, Fayette Co., W. Va., $83,408.50; No. 5, Thomas Croghan, Charleston W. Va., $78,050; No. 6, Charles H. Strong & Son, Cleveland, O., $68,139.50.

Tunneling by a "Pilot."—The firm of Anderson & Barr have arranged to apply their system of tunnelling by a "pilot," on the South Fifth St. Relief Sewer in Brooklyn, N. Y. This sewer is 12 feet inside diameter and in its deepest point is 59 feet below the surface; the material is supposed to be sand and gravel. Work will be commenced at once.

Sabine Pass, Texas.—The following is an abstract of the proposals for improving the harbor at Sabine Pass Tex., opened by Captain Turtle on the 28th of January:

Rittenhouse Moore, Mobile, Ala.: Brush mattress in place, per cubic yard, $2; placing rock ballast, per ton of 2,240 lbs, 90c.

R. W. Walston, Galveston, Tex.; Brush mattress, $1.86; rock ballast, 85c.

A. M. Shannon & Co., Galveston, Tex.: Brush mattress, $1.90; rock ballast, $1.

David W. Howell, Brunswick, Ga.; Brush mattress, $2.31; rock ballast, $1.27.

H. H. Penny, 63 Broadway, New York: Brush mattress, $1.87; rock ballast, 69c.

James E. Slaughter, Mobile, Ala.: Brush mattress, $2.09 99-100; rock ballast, 99 90-100c.

Louisiana Jetty and Lightering Company, New Orleans, La.; Brush mattress, $1.80; rock ballast, 60c. The contract has been awarded to this company.

River and Harbor Appropriation Bill.—Mr. Willis, from the Committee on Rivers and Harbors has submitted the following report: The Committee on Rivers and Harbors beg leave to report to the House the accompanying bill as a substitute for the bill (H. R. 7972) "making appropriations for the construction, repair, and preservation of certain works in rivers and harbors, and for other purposes," and to recommend the passage of the same.

The estimates for the river and harbor appropriations

for the fiscal year ending June 30, 1886, as given in the book of estimates, amount to $34,507,630. The committee have made recommendations amounting to $12,323,700.

These recommendations are as follows:

102 harbors	$3,368,600
142 rivers	7,600,000
7 channels and inlets	321,500
4 breakwaters	169,000
4 harbors of refuge	152,000
3 ice harbors	23,000
1 dry dock	65,000
1 canal	300,000
Snagging and wrecking purposes	177,000
Examinations, surveys and contingencies	100,000
United States harbor board	50,000
Gauging waters	6,000
Total	12,323,700

Of the appropriations called for in the book of estimates 140 were rejected. The general legislation of the bill is confined to three or four points. A report is required as to locks and dams now improved under State authority upon which tolls are charged; and as to the advisability of purchasing said improvements by the Government.

The report of the Mississippi River is required to be made on or before the 1st December in each year.

Provisions is made for the change or removal of obstructions to navigable streams.

A temporary board is created, to be called the United States Harbor Board, to consist of seven members, to be appointed by the President, of whom two shall be taken from the Engineer Corps, one from the Coast Survey, and four from civil life.

As these provisions will be discussed when reached in the consideration of the bill, it is not deemed necessary to discuss them in the report.

Miscellaneous.

New Berne, N. C., will build a $30,000 court house, just authorized.

Enjoining Natural Gas.—The Pittsburgh City Council has declared war against natural gas until its safety has been sufficiently tested to warrant its public use.

Minnesota Items.—Following Bills were introduced in the Minnesota Legislature, Feb. 2nd to 7th, action being taken when so stated:

Authorizing Ramsay county to issue $160,000 bonds, for an alms house and hospital in the northeast quarter of section 29, range 23. Passed.

Authorizing the St. Paul board of education to issue $100,000 bonds for 5 new school buildings. Passed.

Bill for draining Lake Mary, in Wright county.

Authorizing St. Paul to issue bonds $70,000 for special assessments for grading. Passed.

Authorizing Ramsey county to issue bonds for almshouse and hospital at Como Park.

Authorizing Duluth to issue $25,000 bonds for sewerage. Passed unanimously.

Authorizing Ramsay county and St. Paul to issue $300,000 bonds for a court house and jail. Passed.

To authorize St. Paul to issue $400,000 bonds for sewers, $50,000 for engine houses, etc. Passed.

Authorizing the commissioners of Blue Earth county to issue bonds for a court house, jail, etc.

Authorizing St. Cloud to issue bonds for construction of a dam across the Mississippi river.

Railroad Bridges and Canals.

Gadsden Ala. News.—The railroad from Gadsden to Anniston will be built.

New R. R. Depot.—Dayton, O. is to have a new $230,000 Union Depot.

New City Officials.—Urbana, O. is to have City Commissioners and a City Civil Engineer.

New Bridge—To be built over the Eastern R. R. on Fayette St., Lynn, Mass.

Grading Contract.—Beyer and Lux have been awarded a $16,000 contract for grading University Avenue, St. Paul, Minn.

Mt. Royal R. R.—A company is being formed in Montreal, with a capital of $200,000 to build a railway around Mount Royal.

Spartanburg, (N. C.) and Asheville, R. R.—It is definitely decided to push the above line to completion within the next few months.

Bridge Contract.—M. O'Brien & Sons of St. Paul have been awarded the contract for the building of the substructure of the Rolland St. bridge, St. Paul, at $148,000.

The Sharon and State Line Railroad, which is to run through Mercer County from Sharon, a distance of two miles, was chartered on the 10th. The capital is $60,000. George H. Taylor, of Sharon, Pa., is President.

The Highland Junction Railroad Company has applied for State aid in building a bridge over the Hudson River. The road, it is claimed, will be beneficial to New England in many ways, and Massachusetts is asked to guarantee the interest on not more than $5,000,000 of bonds of the road secured by mortgages, and $50,000, to be paid annually to the State, to be used as a sinking fund to redeem the bonds at maturity.

New Bridge.—Cleveland, O., City Council on the 7th recommended issuing $40,000 of bonds to rebuild Main St. Bridge.

A Peruvian Enterprise.—Mayor Grace, of New York, on being shown a Panama dispatch stating that it was rumored in Peru that Grace Bros. & Co. had arranged for the completion of the Oroya and Cerro de Pasco and the Amazon Railroads at an estimated expenditure of $30,000,000, said: "The railroad in question is the Oroya and Cerro de Pasco. It is to run from Callao to the Cerro de Pasco silver mines, 110 miles distant. Some of the miners are 12,000 to 13,000 feet above the sea. About 80 miles of the road are already built, and part of the remainder is graded. I don't know much about the details, as my brother is looking after the business. I do know that there are a number of English capitalists interested, and that the cost will not be as great as stated."

Cable-Road Contracts at St. Louis.—On the 22d ult. the St. Louis Cable & Western Railroad Company contracted with a number of firms for work to be completed by June 1, on which date the road will be thrown open to the public. The Brownell & Wight Car Manufacturing Co., of St. Louis, were given the contract for twenty-four passenger coaches of the most improved pattern, to be upholstered, and for fifteen grip cars. Smith, Beggs & Ranken were given the contract for a 300 horse-power engine and for three boilers, each 20 feet long and 60 inches in diameter. Fulton Iron Works, St. Louis, contracted for the winding machinery, pulleys, etc. The New Albany Rail Mill Company, of New Albany, Ind., took the contract for manufacturing the conduits. These will be of iron and steel; they will weigh altogether 1900 tons, and will consist of 18-foot sections. It will be some time in February when the streets will be torn up and the conduits laid. The contract for the cable was secured by John A. Roebling's Sons & Co., Trenton, N. J. The cable will consist of 34,500 feet, in one piece, and will be of the best material. It is to be delivered at the cable company's power house on May 1.

The Ottawa, St. Lawrence and Schenectady R. R. was incorporated on the 10th inst., with a capital of $5,000,000. The road is to be constructed and operated from a point on the St. Lawrence, near Canton, where a bridge is to span the river to Schenectady, passing through St. Lawrence, Hamilton and Saratoga Counties. The route defined is substantially the line of survey made by the State Engineer, under the provisions of chapter 897, Laws of 1866, forming the Schenectady and Ogdensburg Railroad. The objects of the new company are to acquire all the rights, franchises, property and assets of the old company; of locating and constructing its line on the route prescribed, and paying into the Treasury of the State the sum of money expended by it for the surveys made under the act of 1866. The length of the road is 190 miles. The Directors are Hiron Kalt, Brooklyn; Frederick W. Patridge, Hiram A. Johnson, Willis A. Barnes, Robert Sewell, Henry Weston, A. D. Breed, George N. Torrence, George J. Gordon, New York; Henry M. Herman, Fort Worth, Tex.; E. Pratt Buell, Flora, Ill.; William A. Collins, Jr., New Brighton, and John B. Finlay, Kittaning, Penn.

Maine's Railroad Trouble.—The people of Maine particularly those in the eastern section, are greatly interested in a railroad bill on which the Legislature is to vote on Wednesday next. The Lake Megantic Railroad Company, a foreign corporation, desirous of running a road across the territory of the State of Maine for the purpose of securing with existing lines an uninterrupted railway communication between the city Montreal and the city of St. John, a few years since asked and received a charter from the Maine Legislature, which charter required that the line should touch at a certain point on the foot of Moosehead lake, with the understanding that the road should there connect with the Bangor & Piscataquis road by an extension to be built to the lake by the city of Bangor for that purpose. The city of Bangor accordingly, at great expense, built the extension to the lake.

Now the Lake Megantic Corporation comes forward and asks that its charter may be so amended that the road need not strike the foot of Moosehead lake at all, but may strike the shore about twelve miles up and cross the lake on bridges running from island to island. To grant this change in the charter would, of course, be a great injustice to the city of Bangor, at the same time depriving that port of commerce which she might secure with Montreal were the original plan carried out. The city had been at an enormous expense to build a road into Piscataquis county before the extension to the lake was made, and that extension will have of course added so much more dead weight, providing the Lake Megantic road should be given the desired change of charter.

Notwithstanding the fact that the interests of a large section of the State demand that the original charter be adhered to, the opinion seems to be prevalent that the Lake Megantic, although a foreign corporation, has secured a very strong hold on the Legislature, and the people of the counties most interested are fearful lest the company be granted what it asks.

It would seem that State pride and a desire to secure justice to its own cities and counties should carry the day against a change of charter.—Boston *Globe*.

Canadian Pacific R. R.—By a contract made recently for the transportation of construction supplies on the Columbia River the completion of the Canadian Pacific Railway will be hastened at least a year.

Bridging the Jordan.—U. S. Consul Merrill, at Jerusalem, reports that, during the past summer, an attempt has been made to build a bridge over the Jordan at Jericho. It has progressed slowly, however, as the lumber furnished had to be brought from Europe, and carried on the backs of camels from the port of Jaffa to the river. The Consul suggests that there might be some market in Palestine for American lumber, as the Austrian and Turkish lumber now used there is of poor quality and high priced, but the country is probably too poor to make much of a market for anything at present; the whole yearly imports at Jaffa, which is the Mediterranean seaport for Jerusalem, amount to about $500,000.

Important R. R. Decision.—The Iowa Railroad Commissioners on the 7th decided one of the most intricate and important cases ever before them. Complaint was made that an embankment or "fill" of the Mississippi and Missouri Railroad had stopped the drainage of a large area of bottom or slough land contiguous to the Missouri River, in Mills County, owing to insufficient culverts, thereby causing great damage to crops at heavy rainfalls. The case involved a vast amount of civil engineering, to which Mr. Dey, of the board, who is an expert has given much time for several months. It was found on investigation that the Missouri at the outlet of this bottom land had changed its course nearly half a mile since the railroad was built, eating in toward the road. The question arose as to what effect this would have on the drainage in the sloughs or bottoms, so as to determine whether or not the culverts of the railroad embankment were adequate to prevent overflow and damages. After a thorough investigation the board has decided that evidently the washing of the river bears so important a relation to the evils complained of that they do not feel warranted in recommending any change made by the railroad company in their embankment: but exactly what that relation is they are unable definitely to determine.

Minnesota Bridges.—Bills were introduced into the Minnesota Legislature, Feb. 2nd to 7th, appropriating money or authorizing the issue of bonds for bridge construction as follows:

Authorizing village of Red Lake Falls to issue bonds for street an 1 bridge purposes.

Authorizing bonds for a bridge in Watonwan county.

$2,000 to bridge the Root river in Fillmore county.

$1,500 for a bridge across the Zumbro river, at Hyde Park.

$400 to bridge Lime creek, in Murray county.

$500 to bridge Beaver creek in Murray county.

$500 to bridge Beaver creek in Murray county.

$1,200 to build a bridge across the Minnesota river between Lac qui Parle and Chippewa counties.

Authorizing St. Paul to issue bonds $14,000 for approaches to the Third street bridge, over the tracks. Passed.

St. Paul to issue $400,000 bonds for the bridge from Sherman street to some place in the Sixth ward. Passed.

$1,000 to aid Renville county to bridge Beaver river at Beaver Falls.

Authorizing St. Paul to issue bonds for the Robert street bridge. Passed.

Authorizing St. Paul to issue bonds to build a bridge across the Mississippi river.

$800 to bridge Traverse creek, in Grant county.

$1,000 to bridge the South Buffalo river in Clay county.

$500 for a bridge across Crow river, Kandiyohi county.

$500 for a bridge across Mud creek, on line between McLeod and Sibley counties.

Authorizing Blue Earth county to issue $75,000 for the erection of a court house and jail. Passed.

$800 for a bridge across the Twelve Mile Creek in Traverse county.

$300 for a bridge in Martin county.

$1,500 for a bridge in Nobles county.

$400 to aid the town of Big Lake, Sherburne county to build bridges across Elk River.

$600 to aid Rock county to build a bridge.

Authorizing Polk county to issue $10,500 bonds to build bridges.

$1,200 to build a bridge in Traverse county.

Authorizing Mower county commissioners to construct and keep in repair all bridges in that county. Passed.

$500 for a bridge in Crow Wing county.

$300 to build a bridge in Todd county.

$9,000 to bridge the Mississippi in Aitkin county.

$1,500 for bridges in Grant and other counties.

$1,500 to bridge the Gull river.

$800 to bridge Lime creek in Murray county.

$700 to bridge Beaver creek.

Authorizing Monroe county to repair bridges in that county. Passed.

$2,500 to build a bridge in Jackson county.

A resolution was introduced that no bill asking for appropriations to build bridges be introduced after February 10. Adopted.

Memphis and Holly Springs R. R.—Messrs. Duvenant and Kelly and Piper are pushing the construction of this road very rapidly. At present rate of progress the line will be completed in sixty days.

The Chicago, Nashville and Southern Railroad Company, is hereafter to be the title under which the New York syndicate will operate, which is to build a road from Carbondale, Ill., to Paducah, Ky.

The Chesapeake and Nashville Railroad survey has reached Summershade, Metcalfe County, Ky., ninety miles from Nashville, and is being pushed as rapidly as the weather and country will admit.

Mil. L. Shore & Western R. R.—Work is progressing satisfactorily on the ore docks at Ashland, Wis. As soon as the season opens work will commence on the road. Thirty-six miles of steel rail are yet to be laid and twenty miles of grading to be done. Right of way is nearly all chopped out.

E. Tenn. Va. & Ga. R. R.—Receiver Fink says that the first improvement will be to lay new steel rails over the entire road and improve the track. Steel rails, good rolling stock and well kept track is a better investment for money than in accidents.

Sheffield & Birmingham R. R.—A contract was entered into on the 1st, between the Alabama Improvement company and Messrs. Leuddermann & Co., of Tuscumbia, Ala., for the extension of the Sheffield and Birmingham railroad from its present point to the river.

The St. Louis Bridge.—The report of the St. Louis Bridge Company shows that during last year a total of 445,676 cars, of which 301,315 were freight cars, crossed the bridge, an average of 1,221 daily, including Sundays. On the upper roadway 1,196,292 passengers, 428,570 vehicles and over 30,000 animals crossed.

Augusta, (Ga.,) Gibson & Sandersville, (N. G.) R. R.—Annual Meeting was held at Augusta, Ga., on the 3rd. Officers were re-elected. President is R. M. Mitchell. Road is 78 miles long; ten miles completed; bonds not exceeding $950,000 were voted to complete balance in time for next season cotton crop.

Railroad Building in North Carolina.—Among the many railroad projects now on foot in this State, the one that seems to have the most solid foundation is the proposition to build a short line from Wilson via Fayetteville to Florence, S. C. Colonel R. R. Bridgers, president of the Wilmington and Weldon railroad, has been in Fayetteville, it is stated, to give his personal attention to a survey of the new line.—*Charlotte Observer.*

Bridge at Winona, Minn.—A committee of fifteen of the Board of Trade, representing the heavy property interests of the city, appeared before the city council to urge action on the project of a bridge across the Lake south. The city council passed resolutions favoring the project, appointing committees to draft an enabling act to issue $10,000 in bonds and to examine plans for a bridge.

R. R. Bridge.—Judge McMillin has introduced a bill into Congress which has been referred to the Committee on Commerce, to give the consent of Congress to the construction of a railroad bridge by the East and Middle Tennessee Railroad Company over the Cumberland and Caney Fork Rivers. It authorizes them to construct a bridge over the Cumberland River in or near the corporate limits of Carthage, the bridge to be so constructed as to provide for the passage of railroad trains and wagons across the river. If the bridge is made with unbroken and continuous spans, they shall not be less than 164 feet in the clear, and the main span shall be over the main channel of the river, the lowest part of the superstructure to be at least 34 feet above extreme high water mark. If constructed as a draw bridge the spans shall not be less than 100 feet in the clear. No bridge shall be erected which materially obstructs the free navigation of the river. Authority is also given to construct a railroad bridge over the Caney Fork River at such point between the mouth and the Buffalo Valley as may be necessary in the building of the railroad.

The Steepest Railroad Grade.—There are several steep grades on railways in this country. The Atchison, Topeka & Santa Fe has one over the Raton mountain, the steepest portion of which is 285 feet to the mile. The Denver & Rio Grande climbs at one place a grade of 220 feet per mile, but the J., M. & L. takes the lead, which is found on what is known as the Madison hill. Length of hill, two miles; average grade, 211.86 feet per mile; grade at steepest part (7,000 feet long), 307.30 ft. per mile. On this hill are used two engines. The passenger engine, light, exclusive of the tender, weighs 89,600 pounds; eight drivers. Freight engine, light, exclusive of tender, weighs 112,300 pounds; ten drivers. All weight on drivers. This hill has been the source of much trouble to the company. Various experiments to overcome the grade have been tried and abandoned. The third rail with cog face, in which worked a cog driver, was brought into requisition, which for a short time worked quite satisfactorily, but of necessity was abandoned, and followed by the present pattern of engine in use, low, heavy, all weight on drivers, with as many drivers as practicable.—*Indianapolis Journal.*

Way down in Maine the people of Houlton, Me., are agitating the question of building a railroad from there to Bancroft.

Chicago, Ill. Improvements.—The Commissioner of Public Works asks for the following: Bridge at State street, $40,650; removing old one to Eighteenth street, $10,000; new center pier, etc., for latter, $30,000; bridge, abutments, etc., at Twelfth street, $57,640; double bridge, abutments, etc., at Lake street, $65,000; viaduct at Indiana street, $45,000; extending sewer on Armitage avenue to Hirsh street, via Western avenue, $80,000; sewer in Archer avenue from present terminus to the limits, $20,000; extension of general system $150,000; cleaning, $193,995; City Hall, $57,600; paving street intersections, $773,963.

Government Notes.

A REPORT from Captain Edward Maguire, Corps of Engineers, of the results of a survey of Scajacuada Creek, Buffalo, N. Y., has been transmitted to Congress by the Secretary of War, in which it is estimated that the cost of dredging required for a channel about one mile long and ten and a half feet deep would be $20,000.

THE Secretary of the Treasury has forwarded to Congress the following estimate of appropriation received from the Secretary of War for the construction of quarters for enlisted men at the Military Academy: "For the construction of sixteen sets of quarters to be built in groups of four each, each set to contain four rooms and to be one-story high, to be immediately available, $14,059.80."

THE Secretary of War has transmitted to Congress a report from Captain H. S. Taber, Corps of Engineers, U. S. Army, of the results of a survey of Red River above Fulton, of Little Red River and Petit Jean River, Arkansas, and recommending that a moderate appropriation for the improvement of each be made.

THE Committee on Claims of the Senate has made an unfavorable report upon the petition of Charles Murphy claiming damages against the United States to the extent of $283,125.47 for alleged violation of contract entered into with the petitioner for the excavation of a pit for a dry-dock at Mare Island, Cal.

THE Secretary of War has transmitted to Congress a copy of a report from Lieutenant Colonel H. M. Robert, Corps of Engineers, of the results of a survey made under his directions, to comply with requirements of the river and harbor act of July 5, 1884, of Salmon River at and below Covington, N. Y. From the facts presented by Lieutenant Colonel Robert of the present and prospective demands of commerce it appears that an improvement to the extent of a dredged channel seventy-five feet wide and nine feet deep at low water between Fort Covington and the boundary line, estimated to cost about $30,000, would be judicious at this time if its continuation by the Canadian Government could be assured.

THE Supervising Architect of the Treasury has called the attention of Congress to the necessity for an additional appropriation of $12,000 for the public building at Abingdon, Va., and $15,000 for the public building at Harrisonburgh, Va., in order that they may be made fire-proof.

LIEUTENANT COLONEL GEORGE H. ELLIOT, Corps of Engineers, U. S. Army, has recommended to Congress the removal of the obstruction in Warren River, Rhode Island, at a cost of $2,500 or $3,000.

Market Report of Engineering Materials.

New York, February 12, 1885.

NOTE.—The following Market Report gives wholesale prices on the New York Market unless otherwise stated. It is intended as a general guide to the estimating engineer, and both the range of material and the market location will be extended as rapidly as possible. We give it with this caution, that, as is well understood in business transactions, the amount of bill, distance from market centre and conditions of payment will have a material influence on the final paying prices.

IRON.

STRUCTURAL IRON.		
Angles	2.3c.	@ 2.6c.
Tee	2.8c.	@ 3c.
Beams and channels	3.0c.	@ 3.5c.
Tank	2.2c.	@ 2.3c.
Shell	2¾c.	
Steel plates, Tank	3c.	@ 3¼c.
WROUGHT-IRON PIPE.. PITTSBURGH.		
Butt welded, black.....Discount	47½	
" " galvanized..... "	40	
Lap welded black..... "	67½	
" Galvanized..... "	50	
Boiler tubes..... "	60	
RAILS.		
Steel (large lots at mill)	$27 @ 30	
Old rails	16.50 @ 17 50	
R. R. spikes		3c.
R. R. splice-plates	1.65c. @ 1.75c.	
R. R. Track Bolts	2¼c @ 2¾c.	
Barb-wire fencing, galvanized		5c.
" " painted		4c.
Corrugated iron		
Nails.		
Iron	2.25	
Steel	2.35	

METALS.

COPPER.		
Lake Superior	11¼ @ .11½	
Other Brands	10¾ @ 11	
LEAD.		
Com. Domestic	3.60 @ 3.70	
Lead Pipe	.05¾	
Tin-Lined Lead Pipe	.15	
Sheet Lead	.06¾	
ZINC.		
Sheet	.05 @ 05½	

BRICK.

(Cargoes afloat)		
Haverstraw 1st.....per M.	$6.00 @ 6.25	
" 2nd..... "	5.62 @ 5.87	
Fishkill	4.75 @ 5.50	
Up-River		
Jerseys	5.25 @ 6.00	
Long Island		
" pale		
FRONTS.		
Croton red	14.00 @	
" dark	14.00 @	
" brown	12.00 @	
Philadelphia pressed	22.50 @ 23.00	
Trenton "	22.50 @ 23.00	
Baltimore "	37.00 @ 41.00	
Buff "	33.00 @ 35.00	
Enameled English	65.00 @ 130.00	
" American	85.00 @ 120.00	
Fire brick	25.00 @ 40.00	

CEMENT.

PORTLAND.		
Robins & Co., Extra English 425 lbs. per bbl.	2.75 @ 2.90	
K. B. & S. English 400 lbs	2.85 @ 3.00	
Burham " "	2.70 @ 2.85	
Rochester Castle " "	2.50 @ 2.60	
J. B. White & Bro. " "	2.50 @ 2.60	
Other brands, " "	2.40 @ 2.50	
Keene's fine " "	9.50 @ 9.75	
" course " "	5.25 @ 5.50	
Roman	2.75 @ 3.50	
Dyckerhoff, German 400 lbs	2.60 @ 2.65	
Star, " "	2.60 @ 2.65	
Alsen, " "	2.55 @ 2.60	
Hanover " "	2.40 @ 2.50	
Other brands, " "	2.35 @ 2.40	
Saylor's American	2.15 @ 2.50	
Rosendale cements	0.90 @ 1.00	

LIME.

Rockland common per bbl	1.00	
" finishing	1.20	
Glensfalls, common	.85	
" finishing	1.05 @ 1.10	
Kingston, ground	0.95	

STONE.

Cargo rates at New York.

Amherst freestone, No. 1 per cub. ft.	0.90 @ 95	
" " No. 2 "	0.75 @ 0.80	
" " light drab "	0.80 @ 0.95	
Berlin " in rough "	0.75 @ 1.00	
Berea " " "	0.75 @ 1.00	
Brownstone, Portland, Ct. "	1.00 @ 1.30	
" Belleville, N. J. "	0.75 @ 1.25	
Granite, rough	0.60 @ 1.25	
Common building stone per load	2.00 @ 3.00	
Base stone, from 2½ to 6 ft. lengths, per lin. ft.	0.40 @ 3.00	

SLATE.

Purple roofing per square	6.00 @ 7.00	
Green "	6.00 @ 7.00	
Red "	15.00	
Black Penna. (at New York) "	4.50 @ 5.00	

LUMBER.

PINE, Common box per M.	18.00 @ 20.00	
Good "	55.00 @ 60.00	
Tally plank, 1¼ in each.	.44 @ .50	
Tally boards, dressed "	.28 @ .30	
SPRUCE, Boards dressed "	.25 @ .28	
Plank, 1¼ in "	.28 @ .30	
" 2 in. "	.38 @ .40	
" 2 in. dressed "	.43 @ .45	
Timber per M.	20.00 @ 22.00	
HEMLOCK, Boards each.	.18 @ .20	
Joist, 2¾ × 4 to 4 × 6 in	.17 @ .44	
OAK per M.	55.00 @ 65.00	
CYPRESS 1, 1¼, 2 and 2½ in "	35.00 @ 40.00	
YELLOW PINE, Girders "	26.00 @ 35.00	
Dressed flooring "	30.00 @ 40.00	
SHINGLES, Extra shaved pine, 18in. "		
" " sawed 18 in. "	4.50 @ 5.00	
LATH, Cargo rate	2.50 @ 2.60	

PAINT.

Lead, white, American dry per lb.	.04¾ @ .05	
" " in oil pure "	.05¾ @ .05¾	
English, B. B. in oil "	.08½ @ .08¾	
Red, American "	.05¼ @ .05¾	
Litharge "	.05 @ .05¼	
Venetian red, American "	.01 @ .01¾	
Indian red "	.05 @ .10	
Vermillion, American lead "	.11 @ .11½	
Paris green "	.15 @ .19	
Umber, Amer. raw and powdered per lb.	.01¾ @ .01½	
Drop black, Amer.	.08 @ .12	
" " "	.09 @ .11½	
Chrome green	.05 @ .15	
Oxide zinc, American	.03¾ @ .04	
" French	.06¼ @ .06½	

PITTSBURG, Pa., Feb. 7.—Laboring-men are inclined to believe that times have commenced to get better. There is more work to do now than two months ago, but wages are from 10 to 15 per cent lower. A visit to several labor headquarters this afternoon elicited a statement that there are at least a third less idle men in the city now than the 1st of January. The pipe-mills have been about the only ones that have had anything like a boom in trade. The nail-works in the western district are starting up and the price of nails is gradually increasing. Reports from nailers in various parts of the country are very encouraging.